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CULTURAL SEQUENCES AT THE DALLES, OREGON

A Contribution to Pacific Northwest Prehistory

L. S. CRESSMAN

Professor of Anthropology, University of Oregon

In Collaboration with

David A. Cole, University of Oregon
Willow A. Pierce, University of Oregon
Thomas M. Newsome, Portland State College
David J. Stuckenrath, University of Oregon

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DECEMBER, 1960

To
W. S. NELSON
Manager of the Chamber of Commerce,
The Dalles, Oregon
Civic Leader of Broad and Far-seeing Vision,
Supporter of Education and Science,
Loyal and Understanding Friend,
this study is dedicated.

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PREFACE

The first salvage program in the Columbia River Basin was that of 1934 under W. H. Krieger of the Smithsonian Institution during the building of the Bonneville Dam. The River Basin Surveys program was developed after World War II with the extensive dam-building program of the federal government in the various river basins of the United States. When the Grand Coulee Dam was built, no salvage program existed and the University of Oregon sent some graduate students as volunteers to do what they could there. Some financial support was given by the Eastern Washington Historical Society to the program. Eventually the University of Washington and Washington State College joined the program and a National Youth Administration project was set up. In addition to the N.Y.A. group, students from the two Washington institutions and the University of Oregon contributed to the work.

Following World War II with the development of the R.B.S. program, an office and laboratory was set up in cooperation with the University of Oregon on the University campus. The Columbia River Basin was intensively surveyed and excavations were carried out at various dam sites, the most important of which was McNary Dam, east of Umatilla, Oregon. When the construction of The Dalles Dam was planned, the National Park Service, which was now responsible for salvage work in this part of the country, entered into contracts with the University of Oregon for work on the Oregon side, and the University of Washington on the Washington side of the Columbia River. The Columbia River thus has seen the development of the whole archaeological salvage program from the initial emergency measures up through the organized river basins program into that administered by the National Park Service with cooperating institutions. This paper will be concerned with the work performed under contract between the National Park Service and the University of Oregon covering the years 1952, 1953, 1954, and 1956. The work during the field season of 1955 was financed by the National Science Foundation as a part of a grant made to L. S. Cressman on a larger problem, Oregon coast prehistory, of which this was a part.

In 1950 and 1951 the University of Oregon under the direction of L. S. Cressman had started a program of systematic research on the prehistory of the Oregon coast and the possible relation of the cultures and populations of that area to those of the interior. A matter of critical importance toward the solution of this problem was the consideration of the roles played by the major rivers in Oregon leading from the interior to the coast. Our plans had called for work in critical areas along the coast at first to get a substantial body of information on that area. This was then to be followed by work along the various rivers of which the Columbia River is the most important. We had made a survey of the coast with the aid of grants from the American Philosophical Society and the Wenner-Gren Foundation and, in 1952, carried out a six-week field session at the mouth of the Coquille River, on the southern boundary of the Coos area.

In the meantime, the program for the construction of The Dalles Dam had proceeded and the whole problem of salvage in the reservoir area was pressing. An initial contract on a small scale was entered into between the National Park Service and the University of Oregon for excavation at Big Eddy, WS-1, Oregon Archaeological Survey Code (35-WS-1, R.B.S. code)[1] about five miles east of The Dalles. This was a portion of a much larger site and all that was then available for excavation. Five of the students who had been on the field party in the coast area transferred to The Dalles project and worked for approximately three weeks under the direction of Mr. Lloyd R. Collins as field foreman. The program for 1953 called for excavations at the site WS-4 (35-WS-8, R.B.S.) at the head of Fivemile Rapids, of which Big Eddy was the western terminus. Work was also planned at site 35-SH-20, 21 (R.B.S.), at the mouth of the Deschutes River on the eastern side of its confluence with the Columbia. However, test examinations of the two sites convinced us that WS-4 was of more importance, and since the re-located highway, U. S. 30, was to cross that site late in the summer of 1953 or early fall, it was imperative that that place be given our major attention. A testing program we carried out in the spring of 1953 showed that the depth of occupation there was something over twelve feet. In addition, at WS-4 there was considerable evidence of cremation and it was hoped that this site would give us stratigraphic evidence upon which some conclusions could be based on the appearance of that complex in the Columbia River area. Amateur collectors between late spring of 1953 and the time when we started our work in June, badly damaged the site, but not sufficiently to prevent an extensive program of excavation.

With a party of five students, three of whom had extensive field experience, the season in 1953 was spent in excavating the site, WS-4. Collins was the field

[1] The River Basin Surveys formerly used the code as used in this paper. The initial number referred to the state, the letters to the county and the final number indicated the serial number of the site. Thus 35-WS-1 referred to site number 1 in Wasco county, Oregon. After the completion of this study the coding system was changed by dropping the dashes, so the same site now is indicated 35WS1. The Oregon Archaeological Survey Code uses an initial two-letter designation for the county and a number, separated by a dash from the letters, to designate the serial number of the site. Thus the Oregon code designates 35WS1 as WS-1.

foreman but I was with the party at all times. In 1954 we continued excavations at another point in the same site, known as the Roadcut, as a result of discoveries made during the previous year. Again, I was in the field continuously with the party and Mr. David L. Cole was the field foreman.

The work of the 1954 field season showed a remarkably long sequence of occupation in the area, probably from the end of the Pleistocene down to the time of the replacement of the Indian population by the arriving white settlers. The 1954 program had shown the possibilities of the site, but we did not have a sufficiently large cultural inventory nor did we have sufficient information about the geology of the site to prepare an adequate report.

While the program of salvage archaeology at The Dalles had interfered in a way with the coast prehistory program, it had been of very great importance to it in giving us the promise of this long cultural sequence which might be used as a frame of reference in our study. Otherwise, the chief effect on our program was that it simply moved the study of the relation of the rivers to our problem up to a somewhat earlier point in our schedule. In 1955 the excavation of the site at WS-4 was continued under a grant from the National Science Foundation as a part of the project in Oregon coast prehistory for which the grant had been made to L. S. Cressman. In 1955 and 1956 there was a demand from various organizations and individuals in the area for further salvage work before the completion of The Dalles Dam. The result of this was that another appropriation was made for continuation of this work and in 1956 the final steps in the program of field work were carried out. Mr. W. A. Davis, graduate student in the Department of Anthropology at the University of Oregon, was field foreman for the 1955 excavations and Mr. David L. Cole again took over as field director of the 1956 excavations. I was not present continuously in either 1955 or 1956, but participated by short visits and inspection trips.

In addition to the National Park Service and the National Science Foundation, I wish to express my appreciation for financial contributions to this program to the Research Council of the University of Oregon and to the Clark Charitable Trust through the kindness of Mr. and Mrs. Freeman Day of Eugene. The Corps of Engineers, United States Army, through the District Office in Portland, cooperated with us to the fullest extent and helped us in many ways. Special mention should be made of Colonel H. B. Elder, Resident Engineer, The Dalles Dam, for many courtesies extended to us; to Mr. Wheeler H. Rucker, then Project Engineer at Big Eddy of the Dalles-Celilo Canal; to Mr. Ernest C. White, who succeeded Mr. Rucker as Project Engineer; to Mr. Lloyd Ruff, geologist, District Office, Portland, of the Corps of Engineers; Mr. Sam Sargent, Resident Geologist at The Dalles Dam; to Mr. W. S. Nelson, Manager, The Dalles Chamber of Commerce; to the Wasco County-Dalles City Museum Commission; to Mr. Truman Collins of Portland. Members of the Oregon Archaeological Society gave assistance in excavation both in 1953 and 1956. I wish also to express my thanks to the Oregon State Highway Commission for granting us permission to work on highway property and for many other courtesies, especially protection of the site between field seasons, as well as giving us important help in other ways. The interest and the cooperation of these people and of many others in The Dalles community, not only greatly facilitated our work during the field seasons but provided very pleasant and happy living conditions and associations for us all.

The Atkinson-Ostrander Company, through the courtesy of Mr. John Morton, Project Manager, contributed substantial assistance in 1956 by providing a bulldozer and operator to remove overburden and prepare the site for excavation.

To the Geochronological Laboratory of Yale University, I am especially indebted for C-14 determinations of age of charcoal specimens from the WS-4 site. Mr. Loye Miller of the Museum of Vertebrate Zoology at the University of California, Berkeley, identified the bird bones, Dr. J. A. Shotwell, Curator, Museum of Natural History, University of Oregon, the mammal bones, and Dr. Dwight Taylor of the United States National Museum prepared the report on the Mollusca. To these men our thanks.

It has seemed wise to present the results of the several seasons of field work on the different sites as a unit, each contributing to the record of the cultural sequences in this area of the Fivemile Rapids. The necessary detailed description of each site will be given at the appropriate time in the following pages, but the effort will be made in this study to handle the results as a unit.

A word of explanation concerning the use of different scales on figures and maps is in order. The English scale is used on figure 1 because all maps giving distances for the area use this scale. Maps 3, 4, and 5 are either Corps of Engineers maps or adapted therefrom and these use the English scale; map 7 was deliberately constructed by use of the English scale, since we were operating from Corps of Engineers data and wished to superimpose on it the data of the "earlier channels." All other scales are metric.

This manuscript, in its original form, was submitted to the National Park Service, Region 4, March 31, 1958, in fulfillment of Contract No. 14-10-434-129 (as amended) between the University of Oregon and the National Park Service. The Regional Director, Lawrence C. Merriam, accepted the manuscript as the Final Report, May 19, 1958. The manuscript in its present form differs from the original only as a result of editing by the senior author and the addition of

Appendix E, a chart giving the stratigraphic distribution of selected artifacts to provide a referent for other workers. I wish to express my appreciation to those who have read the manuscript, made suggestions and called my attention to typographical errors. My thanks are also due to Mrs. Linforth Harrison for assistance with the final proof, and to Miss Constance B. Bordwell for preparation of the index.

This paper is published under joint authorship with those students who contributed significantly in the field and the laboratory, Cole, Davis, Scheans, and Newman. Cole made the initial classification of artifacts based on the 1953 and 1954 excavations, Davis classified and analyzed the stone material from the 1955 season, Scheans the bone and antler, and Newman assisted in the final preparation of the manuscript. The final report is the work of the senior author. My colleagues in this work and I have not always agreed on matters of detail but decisions had to be made to get on with the job, and the senior author accepts full responsibility for the opinions expressed in this monograph.

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I. INTRODUCTION

THE PROBLEM

The major long-range research problem with which this study is concerned is the prehistory of the Oregon coast and its relation to that of the interior. The immediate problem is the time depth and the nature of the prehistoric cultural manifestations at the former Fivemile Rapids of the Columbia River, approximately five miles east of The Dalles, Oregon. The immediate study relates to the long-range program since the Columbia River was a main line of communication between the coast and the interior, although it is not known when this situation was established, and, therefore, the area at The Dalles could possibly throw light on the interrelation aspect of the problem.

THE THEORETICAL BASIS OF THIS RESEARCH

The Northwest Coast Culture Area is subdivided into a series of provinces or segments, one of which is the Oregon coast from the Columbia River to the Klamath River in northwestern California. Even this area is further subdivided on the basis of ethnographic data but it is not known when this subdivision took place or whether it represents an original and stable situation. Interior Oregon was occupied from approximately the end of the Pleistocene, about 11,000 years ago, and this area was marked by the great post-Pleistocene climatic fluctuations. No evidence exists to indicate whether the coast of Oregon was occupied as early as the interior. Occupation of the coast could theoretically have taken place either by coastwise movement or by migration from the interior. Oregon coastal cultural manifestations, even at the ethnographic level, indicate an interior orientation in its social complexity although it must be admitted that it is unknown whether this represents an original or a later situation. At least the Oregon coast data that exist indicate no other basic orientation. Therefore, *the hypothesis is advanced that population movements from the earlier occupied interior down the river valleys were responsible for the initial occupation of the Oregon coast.*

Gradual adaptation to new ecological-cultural situations took place during the progress toward the coast with adaptation to the maritime environment as the final stage in a process of adjustment to the new environment. Therefore, the rivers from the interior to the coast should provide the archaeological record of this process of adaptation while the coastal areas would give the record of initial occupation with interior traits in evidence together with the subsequent maritime adaptation. Since changes occurred in the culture of the interior, and probably not uniformly in place or time, the different provinces of the Northwest Coast Culture Area should be related to their immediate interior segments in place and the cultural manifestation in time, that is the time of migration, as the place-time referents for study.

Perhaps it is platitudinous to say that any problem of the prehistory of a given area is one to be defined in a perspective of multiple dimensions. It is true enough that this is the case when the history of an area is considered within the boundaries of its own dimensions, so to speak. That is, there are not only the time and space dimensions, but also those of the relation of the peoples and cultures to the ecological conditions at any one time and to the problem of changing environmental situations, if such change has occurred. When, however, we are faced with the numerous and complex problems of trying to determine the time of original occupation of an area, the point or points of origin of the original populations and cultures and the routes of movement and subsequent mobility or stability of groups the problems become infinitely more complex. For example, to take just one aspect of a single facet of the problem: if we are trying to relate the Oregon coastal population to an interior source we are faced with making our comparison of traits on a descending time scale as far as the interior goes. It must be presumed that the source population and culture went through processes of change while the migrant group was moving into the new area. The comparison of the migrant group, established in its new environment, at say x years in time, would have to

be made with the culture of the source group at *x* minus the number of years which had passed since the migrant group set out for new areas. But it is not even this simple. The history of the migrant group is not a static one. It is to be presumed that its culture has changed, too, over the years of its migration, especially if it has passed through new types of environment. Migration compared with flight is a slow process probably with step by step advances and adjustments to the areas of halting for a greater or shorter period. If we can establish the point in time for the original departure the question arises, where along the line of migration are we to find the cultural horizon which is related to that of the point in time and space of their departure. The prehistory of any area is thus a complex series of problems dealing with cultural and population dynamics in terms of time perspective and the ecological areas in which the history unfolds. (Cressman, A Statement of Problems and Progress. Paper read to Society for American Archaeology, Urbana, Ill., May 7–9, 1953.)

This conceptual organization of our problem has a history which it is worth while to examine.

DEVELOPMENT OF RESEARCH THEORY

All theories offered to explain coastal-interior relations until the last few years have been based upon (1) ethnographical data with almost no archaeological information available, and, (2) an ideational orientation which conceived of the northwest coast as one unit and the intermontane area, and in particular the Columbia Plateau, as another. This assumption, usually never made explicit, tended to organize all approaches to this problem. The lack of archaeological information for all practical purposes for both areas meant that ethnographic information from the precontact cultures determined the levels of comparison. To avoid the difficulties inherent in this situation, which provided no comparisons on different time levels, it was necsssary to attempt to reconstruct earlier cultural relations by the usual ethnological methods. In brief, efforts were made to answer the questions, what cultural manifestations were earlier than others, and where did these occur?

Boas (1902) first discussed the problem of coast-interior relations and hypothesized early movements from the interior to the coast where, with strong Asiatic influences, a maritime adaptation took place, and produced the characteristic Northwest Coast Culture. This then influenced the culture of the interior. The historic Jesup North Pacific Expedition had produced but few archaeological results, most of which of any significance came from Harlan I. Smith's excavation at the mouth of the Fraser River. It was on these, however, that Boas hypothesized an early interior influence.

As a result of the ethnographic studies on the coastal Indians of British Columbia, these groups became relatively well known. The development of the culture area concept and its application established the "Northwest Coast Culture Area," extending from southern Alaska to the Klamath River in northern California along a narrow coastal strip. The development of the concept of the cultural unity of this area influenced thinking about it and generally resulted in treating it as a unit diffused from the north without regard to the possibility of its being a coastal adaptation of many east-west movements. It was probably these phases of anthropological thought that organized the early approach to the problem.

Another purely historical situation which tended to throw interest toward the northern part of the area concerned, as the crucial one for study in connection with the relationship problem, was the relative vitality of the British Columbia coastal cultures. When compared with the south, the relative density of surviving Indian populations with the greater availability of reliable informants in British Columbia, and the richness of that culture, made that area a major focus of study. Coastal British Columbia came to stand for the whole of the coastal strip and interior British Columbia and eastern Washington represented the interior. Total areas came to represent or include the parts.

Kroeber (1923) followed Boas in his speculations on the relationships of the areas concerned but saw less direct Asiatic relations. Next Strong *et al.* (1930) discussed this problem and essentially simply restated the older position.

Spier (1930) showed the influences of the coastal area on the Klamath culture in its later stages and, while the Klamaths were treated as typical plateau-riverine peoples, he, nevertheless, did see an old Great Basin element in their culture. Spier thus brought into the sphere of discussion a new area, both in its geographic and in its cultural dimensions.

Ray (1939) using the "age-area" concept attempted to order the ethnographic material from the Columbia Plateau and give time depth to it. His study was primarily concerned with the internal picture of that area.

The Trait List studies of the University of California in the meanwhile turned attention to intensified study of both the coastal and interior areas. Drucker (1936) studied the problem of northwest coast culture and set up three "major provinces." He later (1937) described the southwestern Oregon and northwestern California Athabascan culture. Barnett's study of the Oregon coast (1937) provided the only material available for any realistic approach to the question of the cultural uniformity of the coastal area and showed that the assumed uniformity did not exist. Jacobs had been studying the surviving languages along the coast, collecting myths and folktales and ethnographic information where possible. By the late thirties, then, the picture was essentially unchanged in its larger aspects, but one important development (as a result of the later ethnographic studies) was the awareness of the significance of the internal cultural differentiation. Kroeber (1939) recognized an early relationship between the Columbia-Fraser Plateau and the Great Basin-Califor-

nia areas, bringing a new approach to the study of the interior cultures. Drucker (1955*b*) recognized the possibility of coast-interior relations at an early time level but generally negated their importance and advanced a "new theory" (p. 64). The hypothesis which he then supports is, "Proposed: that the distinctive basic patterns of the northwest coast culture, from Yakutat Bay to northwest California, were derived from the same subarctic fishing-and-sea hunting base of the coasts of Bering Sea and southwest Alaska that gave rise to the various Eskimo and Aleut cultures." This hypothesis returns to the method of unitary approach to the problem together with a descriptive rather than a historical study.

Archaeological studies in the Great Basin, extending from southern Nevada to central Oregon (Antevs, 1925; Harrington, 1933; Cressman, 1942), had shown that not only was the Great Basin occupied at an early period, but the area was subject to great climatic and ecological changes which in turn must have strongly affected the populations of the area. Did the populations remain and die off or did some move out into more favorable areas? The results of these studies for reevaluating the culture history of the Great Basin were largely negated for the time being by the then accepted belief in the late southwestern origin of Great Basin culture which required the refusal to accept the chronology suggested, since it did not fit in with established dogma. However, the C-14 method of dating (Libby, 1952, 1955; Cressman, 1951) validated most of the dates for the Great Basin events, giving a greater antiquity to some than had originally been assigned. The picture that took shape was one of a significant cultural development in the Great Basin of far greater antiquity than anything known along the coast. If this were true, granting that still nothing was known of the coast archaeologically, then there was the possibility of migrations out of the Great Basin and some of these might have led to the coast. During the arid period of the altithermal in the Great Basin the Columbia River to the north and the rivers of the Cascade-Sierras to the west provided water and food; and if refugee populations moved to the more favorable areas, then, once there, the migrants could adapt to the new environment, eventually moving to the sea.

The systematic program of research carried out by the writer on the northern Great Basin and adjacent areas had, by the end of the 1940's formulated a series of problems concerning time of occupancy, sources of population, and population movements. Following World War II, the archaeological information on the interior was rapidly expanded with the development of the salvage program of the River Basin Surveys. However, H. Krieger has not published on his work at Bonneville Dam in 1934 and the program at Grand Coulee (Collier *et al.*, 1942) had produced but limited results and these related to the time of contact or that immediately preceding. Osborne (1957) conducted extensive excavations at the McNary Reservoir but again these sites showed little time depth beyond the contact period. Daugherty (1956) excavated at Lind Coulee, a site with a C-14 date of 8,700 ± 400 (average of two samples) years ago. The Lind Coulee site was the first demonstration of Early Man in the Columbia Plateau area of southeastern Washington. This site was of great importance since it showed that human occupation with essentially the same culture as that to the south extended into the Columbia Plateau at a very early date.

Borden's work at the mouth of the Fraser River in British Columbia (1950, 1951, 1954) has been in part concerned with coast-interior relationships and in part with definitions of the coastal culture in that area. King (1950) also called attention to these problems in his Cattle Point paper. Smith (1950) advanced a theory of coast-interior relations and cultural sequences but it has found little support. The writer in 1950 started a systematic survey of the Oregon coast starting at the Columbia River. This extended to Cape Blanco where Berreman in 1935 had terminated a survey, which started at the California-Oregon line. On the basis of the coast survey, Cressman planned a program of field work of not less than five years' duration to work out the major outlines of Oregon coast prehistory and its relation to that of the interior. This research project was formulated on the model set forth in the second paragraph of this chapter.

II. THE SETTING

To place our archaeological area in its geographical perspective in the western United States, we shall briefly discuss the configuration of significant elements of the landscape of the area, then the Columbia River drainage system, followed by the immediate locale of the sites and finally the sites themselves.

THE WESTERN UNITED STATES

(*Cf.* Map 1)

The western United States is an area of high relief. Three mountain ranges, the Rocky, the Cascade-Sierra, and the Coast Ranges, running roughly parallel to one another, are dominating features. The area between the Rocky and the Cascade-Sierra, the intermontane region, is characterized by an arid climate, elevations ranging from 500 to more than 1,500 m. with occasional elevations of 3,000 m., and a limited drainage pattern. Since the terminal Pleistocene the climate has varied from the cooler, moister climate of that time through a long arid, hot period to a somewhat cooler and moister climate; then about two thousand years ago the present climatic situation became established (Antevs, 1948). In the extreme northern part of the intermontane region, the glacial ice extended into northern Washing-

MAP 1. The Western United States, adapted from various sources.

ton with the Canadian portion the last to be freed from the ice cover (Davis and Matthews, 1944).

These climatic changes were obviously correlated with changes in the fauna and flora. In the intermontane area, human occupation has existed from before 10,000 years ago and is distributed on the basis of present knowledge from southern Arizona to southeastern Washington (Wormington, 1957). Man thus had to adjust to a changing ecology and the relations between neighboring ecological systems and those of the Great Basin are significant in his history.

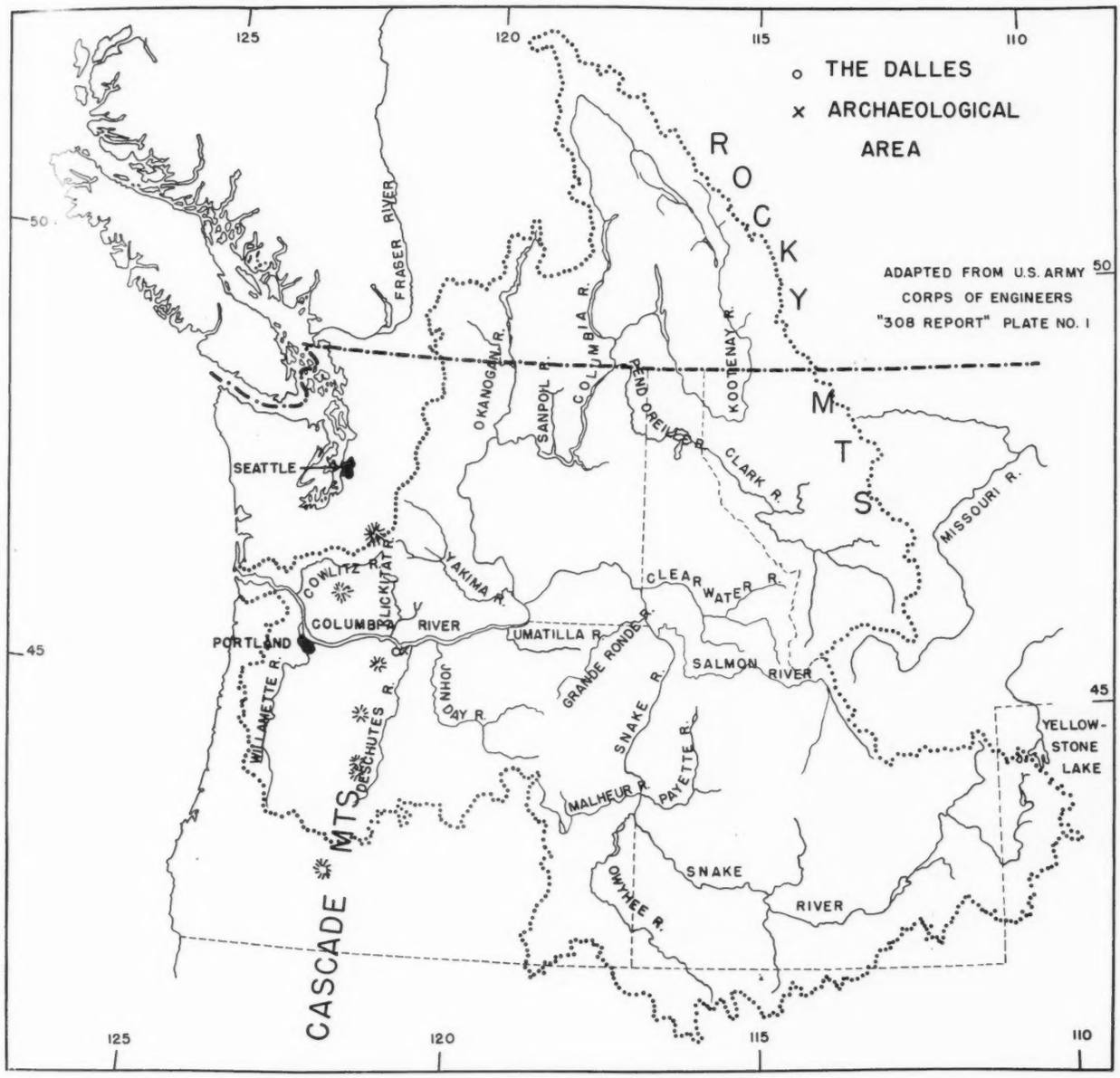
The structural features of the intermontane region divide the area into three subdivisions, the south centering on the Colorado drainage, the Great Basin in the center, and the Columbia River drainage system in the north. The rock system of the south consists in the main of (*a*) Pre-Cambrian intrusives, (*b*) Late Tertiary and Quaternary sedimentaries, and (*c*) some Tertiary igneous intrusives. It is an area of marked faulting. The early sedimentaries give rise to the characteristic mesa-arroyo topography. In the Great Basin, which extends approximately from 35° to 43° N. latitude, there are (*a*) Late Tertiary and Quaternary sedimentaries, and (*b*) some intrusive igneous rocks. The region is characterized by north-south orographic features, aridity, extremes of temperature and interior drainage. The Columbia River drainage system consists mostly of (*a*) Tertiary volcanics, and (*b*) Mesozoic intrusives in the north extending into Canada. Volcanism occurred also in the post-Pleistocene (Libby, 1955). This is the region of the great flows of Columbia River basalt. Extending like a great channel across Idaho is the Snake River Downwarp in the basalts extending to the headwaters of the Snake River. The Columbia Plateau, as the area is called, alone of the intermontane sub-areas has drainage directly to the Pacific Ocean.

The Cascade-Sierra mountain range consists in the Sierras mostly of Mesozoic igneous intrusives while their northern neighbors, the Cascades, are Tertiary and Quaternary volcanics. The Cascade-Sierra skyline is rugged and beautiful. Extinct volcanic peaks, many 3,000 m. high and some more than 1,000 m. higher, stand out starkly against the sky. The lower western slopes are mostly covered by rain forest while the eastern side supports yellow pine. The east slope of the Cascades extends gently to the high lava plateau while that of the Sierras ends abruptly with the fault escarpment. These mountains are cut only by the Klamath, the Columbia, and the Fraser Rivers. The Klamath flows from Klamath Lake at the east base of the Cascades in south-central Oregon through the range, across part of northern California and to the Pacific Ocean. Its drainage basin in Oregon is small. The Fraser parallels a portion of the Columbia River in British Columbia, and then cuts through the mountains to the sea at Vancouver. Its drainage basin, while larger than that of the Klamath, is small when compared with the Columbia's.

The Pit River in the Pleistocene drained northeastern California and Goose Lake in Oregon into the Sacramento after breaking through the Sierras. Possibly this drainage functioned occasionally in the post-Pleistocene.

Between the Cascade-Sierras and the Coast Range is the great Interior Valley of California separated by the Siskiyou Mountain System from the Puget Trough or Depression in Oregon and Washington. The rock systems of these depressions consist of sedimentaries. The Central California Valley is drained by the Sacramento and San Joaquin Rivers into San Francisco Bay. The Oregon portion of the Puget Trough drains through the Willamette River into the Columbia River at Portland, while much of the Washington portion drains into and/or is occupied by Puget Sound.

The Coast Range mountains are mostly deformed Tertiary sedimentaries and volcanics with some Mesozoic metamorphics in the south. The highest point of the Coast Range, Mount Olympus, slightly more than 2,000 m. in elevation (7,954 feet), is a part of the Olympic uplift in northwestern Washington. Elsewhere the elevations run little more than 300 m. with occasional peaks extending slightly over 1,500 m. The Coast Range is characterized by heavy winter rainfall, rain forest as far south as San Francisco Bay, and numerous short rivers draining the western slopes to



MAP 2. The Columbia River drainage basin.

the sea. A few rivers, especially the Rogue and Umpqua Rivers in Oregon flow from the western slopes of the Cascades through the Coast Range to the sea. Except down the rivers, passage across the Coast Range in aboriginal times would have been very difficult because of the tangle of the rain forest.

Since we are concerned with the problem of interior-coast relations as reflected in human occupation and since the Columbia drainage system was least affected by the post-Pleistocene climatic fluctuations, and has had throughout its history contact with the Pacific Ocean, we shall turn our attention to that area.

THE COLUMBIA RIVER DRAINAGE SYSTEM

(*Cf.* Map 2)

4. Columbia River rises in Columbia Lake, British Columbia, Dominion of Canada, and flows northwesterly parallel to the Rocky Mountains about 191 miles, then turns southward and flows about 271 miles to the international boundary, whence, in its course of about 745 miles in the United States, it flows generally southward across the State of Washington, skirting the Columbia Plateau on the northwest and west, to the Washington-Oregon State Line, thence generally westward about 310 miles along the State line, passing through the Cascade and Coast Ranges, to its mouth at the Pacific Ocean near Astoria, Oregon. The river and its tributaries drain an

area of 259,000 square miles consisting of rugged north-south trending mountain ranges separated by valley troughs and trenches, and the Columbia Plateau. The latter, formed by successive lava flows, is a great, generally treeless, semiarid plateau covering over 100,000 square miles in the central portion of the basin and extending southerly beyond the basin boundary. About 39,500 square miles of the basin area lie in Canada. Elevations in the basin range from 8,500 to nearly 14,000 feet above sea level in the Rocky Mountain system on the east; 2,000 to 6,500 feet in the eastern valleys; 2,000 to 4,000 feet over the Columbia Plateau; 6,000 to 8,000 feet in the Cascade Range, with some summits exceeding 12,000 feet; sea level to 500 feet on the floor of the Puget Trough between the Cascade and Coast Ranges; and 2,000 to 4,500 feet in the Coast Range at the western edge of the basin. Stream slopes are steep in the mountain reaches and in canyons where the streams cut through mountain ranges. Through valley reaches the slopes are relatively gentle and in the northern portion of the basin the streams flow through numerous lakes. The total fall of the main Columbia River from its source to the ocean is 2,652 feet but its major upper tributaries have much greater fall. The lower 140 miles of the river is tidal.

5. Principal tributaries to Columbia River and their drainage areas are, in downstream order: Kootenai River, 19,300 square miles; Clark Fork-Pend Oreille River, 25,960 square miles; Spokane River, 6,640 square miles; Yakima River, 5,970 square miles; Snake River, 109,000 square miles; and Willamette River, 11,200 square miles. Snake River, the largest tributary, drains the southeastern portion of the basin extending from northwestern Wyoming across Idaho, with small areas in northern Utah and Nevada, to eastern Oregon and southeastern Washington. It contributes slightly more than one-fifth of the mean annual run-off of Columbia River. Kootenai and Clark Fork-Pend Oreille Rivers drain the northeastern section of the basin in Canada, Montana, northern Idaho, and northeastern Washington, contributing together an average annual run-off about equal to that of Snake River. (Corps of Engineers, 1952: 1: 8–9.)

The evidence from our site WS-4 indicates that at the end of the Pleistocene and into the early post-Pleistocene the river ran at a considerably higher level than now. Clayey silts in the lowest 2 m. of artifact-bearing deposit indicate a slack water origin for these sediments. The lowest part of this bed is at approximately 150 feet elevation above sea level while the surface of the river immediately below, before the construction of the dam, was at approximately 55 feet at low water. Assuming that the sedimentation occurred during periods of high water, even if we take the maximum flood stage of June 6, 1894 of 60.1 feet for The Dalles, measured at Celilo (Corps of Engineers, 1952: table 11–5, Peak Stages and Discharges of 1948 flood, 1894 flood, and maximum previously recorded flood, p. 57), and add it to the 55, it would still be 35 feet below the normal high water required for this sedimentation. This high river level at the end of the Pleistocene is accounted for in part, and probably the greater part, by the discharge of the intermontane glaciers in British Columbia and in part by the channel not having been cut as deep as it now is.

THE DALLES

(*Cf.* Map 3*)

The Dalles is the name given by the voyageurs to the section of the Columbia River with its former great rapids about five miles east of the present city of The Dalles and some fifteen to twenty miles east of the point where the river enters the Columbia gorge. The voyageurs were said to have been impressed with the pavement-like character of the great exposure of flat rocks, the surfaces of lava flows in this stretch of the river and named them "Les Dalles," or "the paving stones." La Dalle also means "slab or fillet of fish" and it is conceivable that the slabs of drying salmon at the Indian camps might have impressed the voyageurs as much as, if not more than, the rocks, and the words could conceivably mean "the place of the fish fillets." The first explanation is the generally accepted one.

It is the geological character of the area which gives it its distinctive character as a place for aboriginal use. Sargent (Brief ND) has described the geological history of the Columbia basin as consisting of three stages: (1) volcanism and stream erosion, (2) volcanism which deposited thousands of feet of lavas and obliterated the earlier features, and (3) a final stage of earth deformation and stream erosion. In this final stage the Cascade Mountains were formed and the Columbia cut the Columbia gorge across the rising mountains on its way to the sea. Near the end of the Pleistocene occurred a tremendous flood, the Spokane flood, caused by the breaking of an ice dam, which had formed glacial Lake Missoula. Five hundred cubic miles of water were suddenly released. Flood depths of 1,000 feet are recorded by the debris: giant gravel bars, barren basalt stripped of all soil, and huge granite boulders rafted great distances by icebergs. Man witnessed this flood as artifact evidence indicates but it would have violently disturbed or destroyed most of the evidence of his occupation.

Near The Dalles is an almost complete sequence of rocks representing the last two stages of the basin history. Just west of the city of The Dalles, 3,000 feet of basalt are exposed in the walls of the gorge and south of the city 2,000 feet of sediments occupy a downward fold in the basalt. These sediments once extended much further, but have been removed by the river as it makes a great southward bend in the downfolded basalt.

The channel of the river is distinctive, different from the normal river channel, and is known in scientific literature as the "Dalles type river channel." The series of lava flows over which the river originally flowed is broken by a transverse fault (map 3, fig. 29). Immediately upstream from the fault, the river is wide and flows quietly. Channels were cut in the basalt surfaces downstream with the main one on the south

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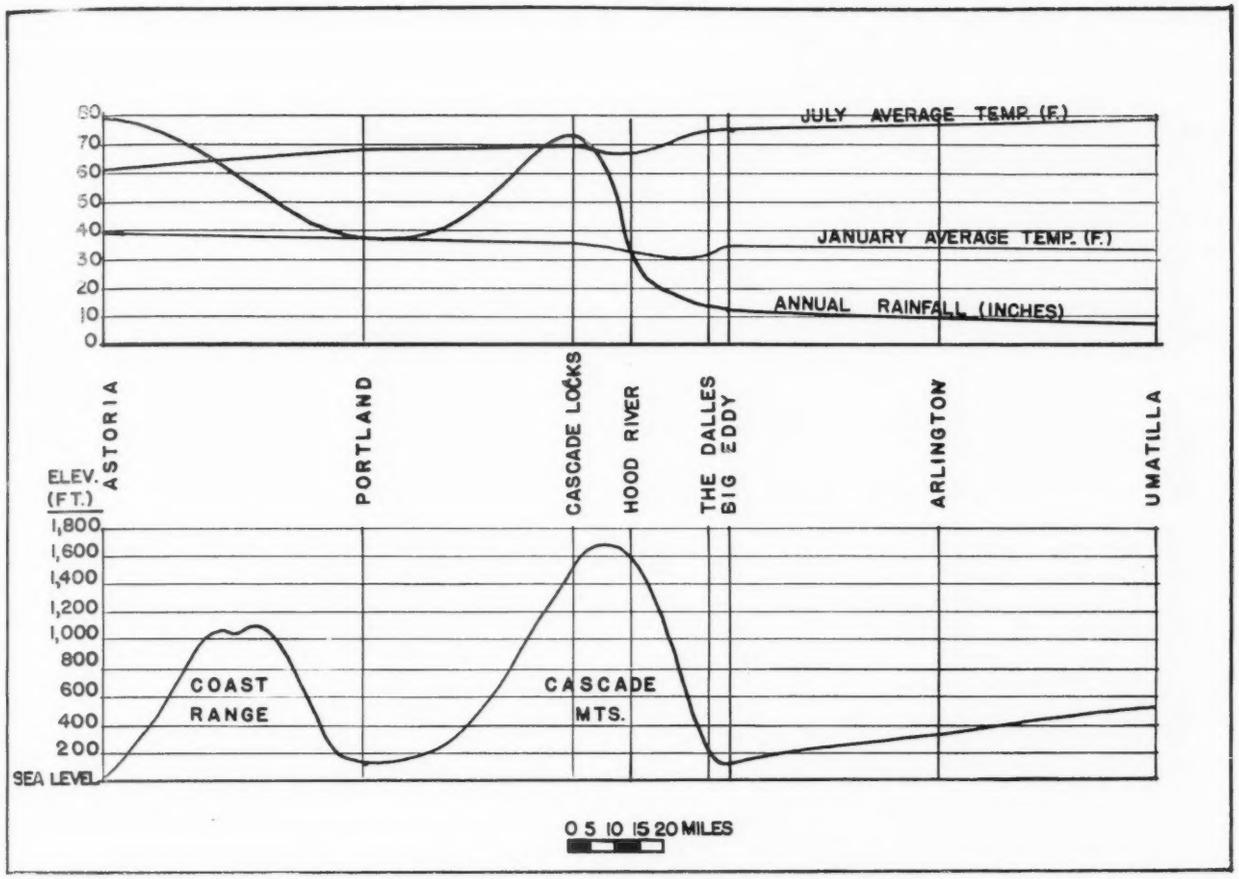


FIG. 1. Temperature, rainfall and elevation profiles from the mouth of the Columbia to Umatilla, Oregon.

side in the lowest part in the downfolded basalt. As the volume of the river was reduced, it came to be confined to the narrow main channel except in times of high water, usually May and June. The channel at The Dalles, although 190 miles from the ocean, for a distance of three miles is entirely below sea level with three gigantic potholes extending far below sea level, one of them to a depth of 300 feet. The upper half of this channel was known as Fivemile Rapids and possibly was caused by retreating waterfalls. During high water, the river ran through many side channels in the basalt and through these where the current was less swift, as well as in the main channel, the salmon moved in countless numbers in their upstream migrations. The deflection of the river and the salmon into these channels in the basalt produced this habitation area probably without equal in western North America.

ECOLOGICAL FEATURES OF THE DALLES AREA

The location of The Dalles area just east of the beginning of the Columbia gorge puts it in a situation of diversified ecological relations. Figure 1 shows, for certain stations of record from Astoria at the mouth of the Columbia to Umatilla, one hundred miles east of The Dalles, average January and July temperatures and rainfall; and in the lower portion, it gives a profile of surface elevations. An inspection of figure 1 shows clearly the effect of the mountains on the rainfall pattern at The Dalles and how the river moderates the temperature in the area. The Dalles lies in the rain shadow of the Cascade Range. The rainfall drops from thirty-five inches at Hood River, twenty miles to the west, to fifteen inches at The Dalles. There is a progressive drop in the amount of precipitation to Umatilla.

The Columbia gorge serves as a funnel through which the moist, cool Pacific air of summer is sucked into the hot area east of the mountains. (*cf.* Tale of "The East Wind and The West Wind," Sapir, 1909: 103). These winds tend to keep down the summer temperature but at the same time, the velocity with which they rush through the gorge and up the river can be extremely disagreeable. If the winds blow from the east in winter, they cause a sharp drop in temperature from that produced by the prevailing westerly winds. In summer, quite the opposite is the case; the winds blowing from

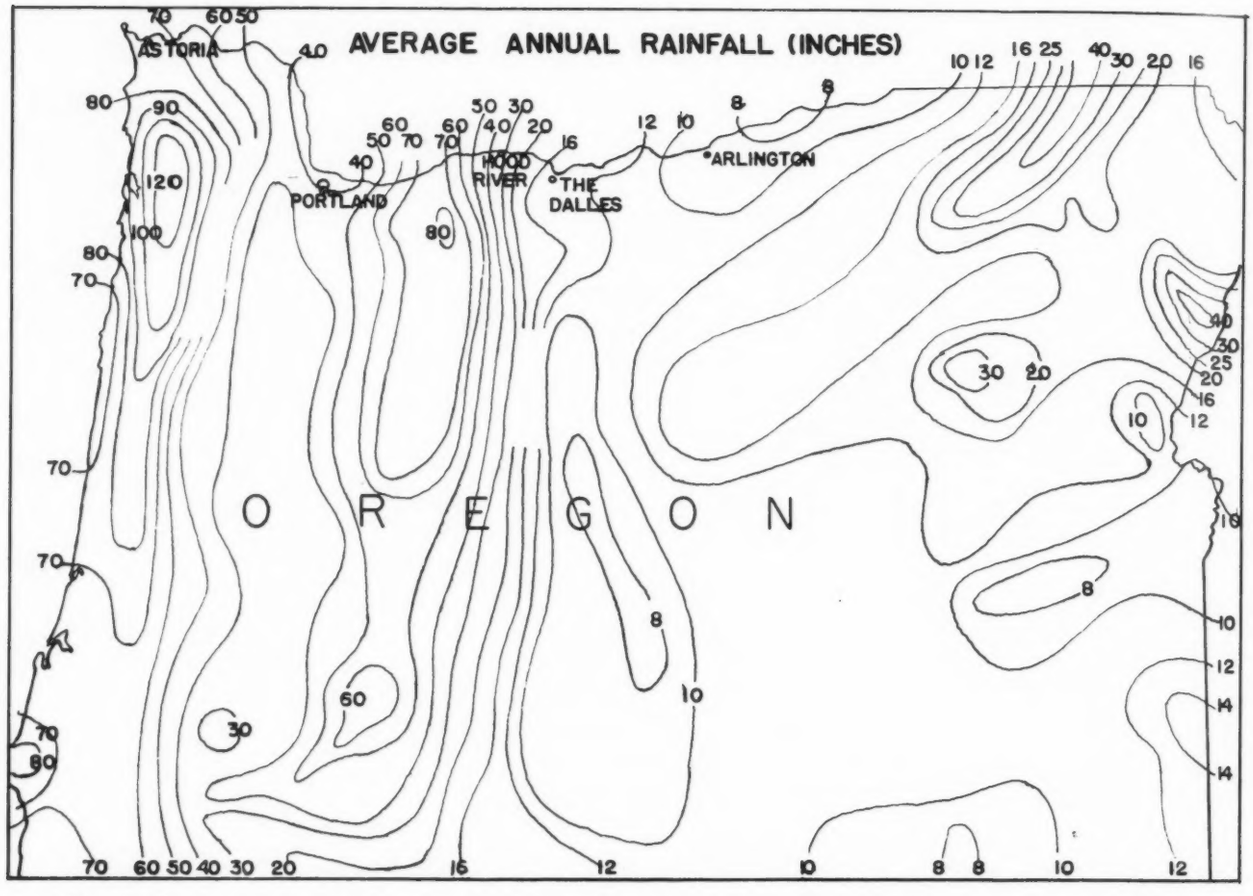


FIG. 2. Average annual rainfall, Oregon 1886–1938; adapted from drawing, page 1085, *Yearbook of Agriculture*, 1941.

the arid eastern plateau will cause a sharp and sudden rise in temperature at The Dalles. The region at The Dalles is thus on the border—between the arid Columbia Plateau and the moist western part of the Columbia River drainage.

Figure 2 shows the isohyetal lines for Oregon. The archaeological area at The Dalles falls in the area having between twelve and sixteen inches of average annual rainfall, and very close to the lower value.

Figure 3 illustrates the distribution of life zones for Oregon and Washington. A wedge-shaped area of the Upper Sonoran Zone stretching from eastern Washington extends well down into Oregon where it pinches out on the upper Deschutes River. Our sites lie close to the western border of this zone where it crosses the Columbia. Bordering the Columbia River on both shores and the western boundary of the zone is the Transition Zone which occupies the trough between the Coast and the Cascade Ranges in both states. The Canadian Zone occurs as great islands within the Transition with the Hudsonian as smaller islands on the higher elevations.

The close proximity of these different life zones provides a wide range of potential food sources for the inhabitants.

There were, in addition to the land animals, the more important resources of the river with the salmon and the sturgeon. Migrating waterfowl were found in abundance on the river. The natural environment afforded a rich and varied supply of potential food if patterns of use were directed to its exploitation. However, the archaeological evidence from an early date confirms the later ethnographic that the use patterns were heavily concentrated on fish.

The vegetation is the usual shrub and brush of the Sonoran Zone, but along the river and the tributary streams are to be found willows and cottonwoods, much fewer now than in aboriginal times. Driftwood, willows, and sage brush supplied the aborigines with fuel. Apparently the latter sources were the more important according to Lewis and Clark.

In summary then, the general ecological picture is that of a people living in a dry zone with a fairly wide range of winter and summer temperatures, but both are modified from extremes like those of the Great Basin by the influence of the river and the lower

elevation. The proximity of different life zones provided a rich supply of food resources both in the plant and animal varieties. To these the river added immeasurably with its wealth of fish, possibly to such an extent that reliance on it reduced the patterns of limited utilization of the other facilities. The river and the geological features discussed above determine the ecological pattern and provide an almost unique situation in North America for aboriginal use.

THE SITES

We are concerned with two main sites, WS-1, Oregon Archaeological Survey Code (35-WS-1, RBS Code) and WS-4 (35-WS-8, RBS). WS-1 lies at the west end of Fivemile Rapids (map 4) and just across from Big Eddy, and WS-4 is at the head of the rapids (map 3, fig. 29). The character of these sites changed markedly from the time of initial occupation until their excavation. Therefore, we shall give, as far as it is possible, a description of each site at the time occupation started, as well as at the time of excavation. WS-1 was so modified by the construction on and through it that practically nothing beyond its general initial extent can be inferred. However, WS-4 is quite different and

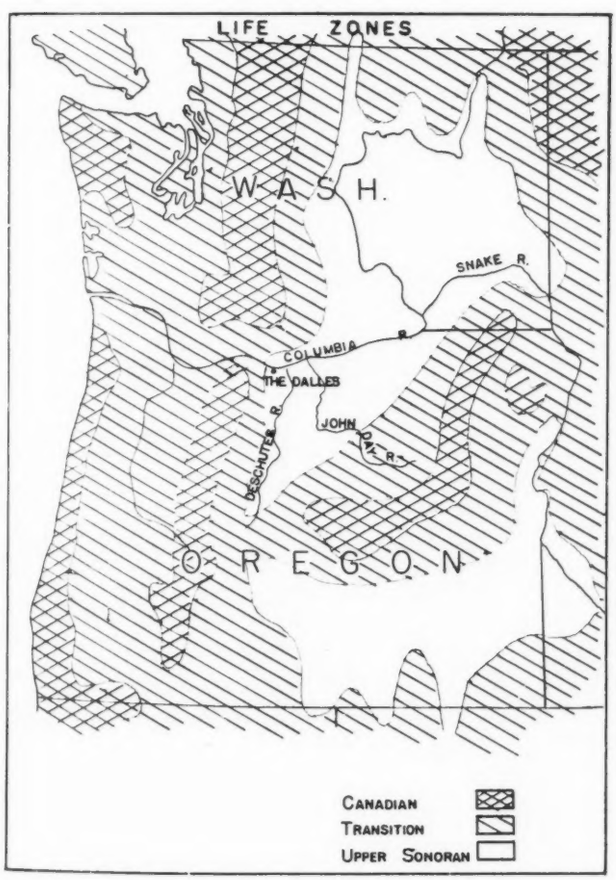
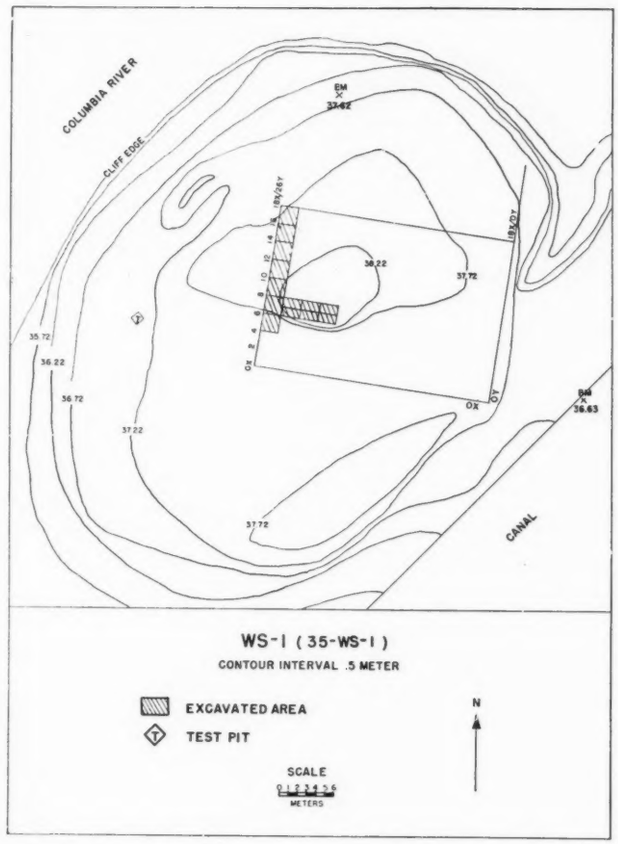


FIG. 3. Life zones of Oregon. Adapted from Bailey, 1936.



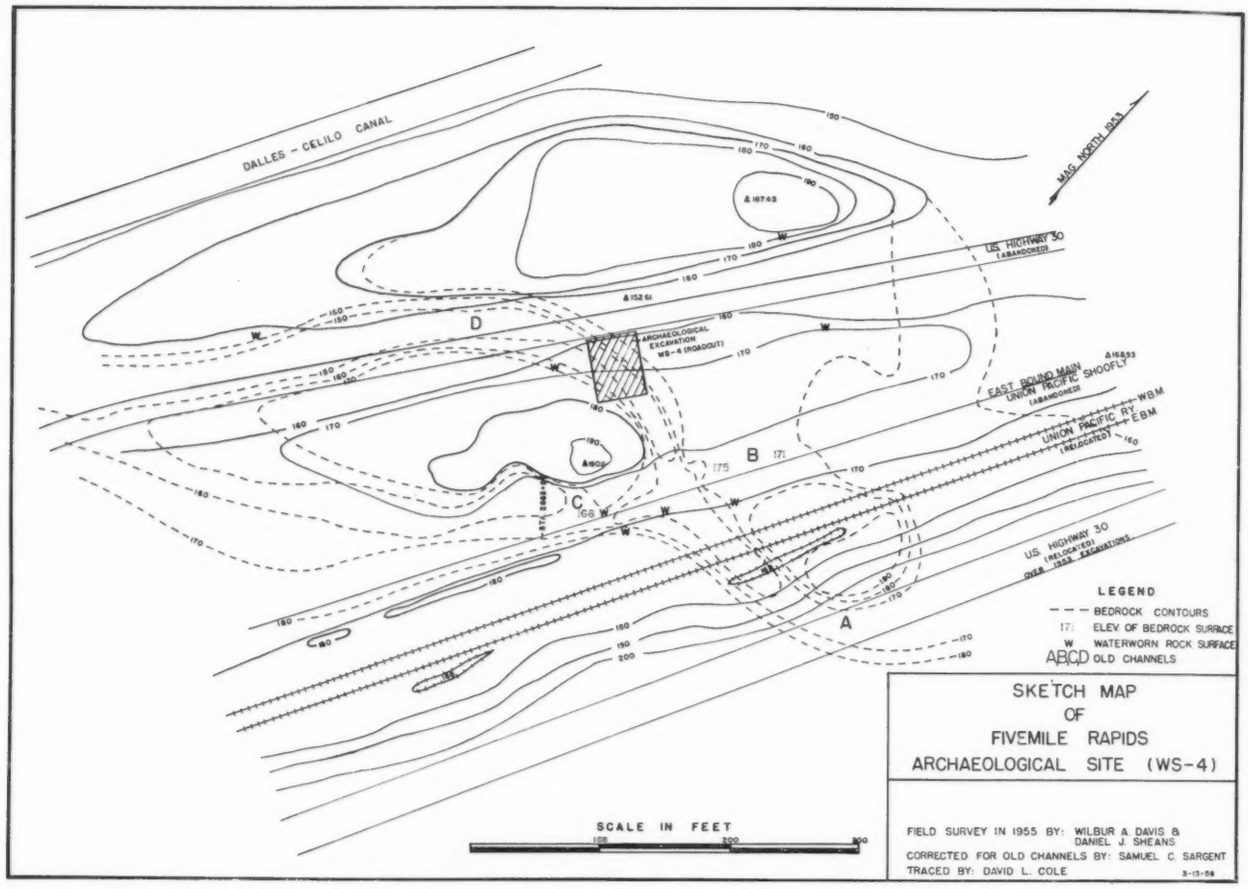
MAP 6. WS-1 (35-WS-1) 1952–1953 area of excavation and plan.

the original situation at that point can be reasonably well constructed.

SITE WS-1 (MAPS 4, 5,* 6, FIG. 29)

This site lies about five miles east of The Dalles on the south bank of the Columbia River. The deposit originally extended from the rimrock at the base of the massive cliffs to within a few meters of where the bank drops off in sheer cliff to the river, a distance of about 200 meters. The east and west boundaries are not known with any certainty, but there must have been an included extent of more than 300 meters. The site is at the west end of the rapids known as the Fivemile Rapids (the Long Narrows of Lewis and Clark) at the point called Big Eddy. On the river side of the site, the Celilo Canal cuts through, and the locks and administration buildings for the Corps of Engineers were built probably on the part of it which was leveled for that purpose. Various service buildings also were built on what was probably a part of the original site. Seven dwellings and auxiliary buildings for the personnel of the staff were built on another part of the site. The original Columbia River highway traversed the

* Maps 3, 4, and 5 are in envelope at back of book.


DALLES - CELILO CANAL
MAG. NORTH 1953
U.S. HIGHWAY 30 (ABANDONED)
ARCHAEOLOGICAL EXCAVATION WS-4 (ROADCUT)
EAST BOUND MAIN UNION PACIFIC SHOOFLY (ABANDONED)
UNION PACIFIC RY. WBM
UNION PACIFIC RY. EBM (RELOCATED)
U.S. HIGHWAY 30 (RELOCATED OVER 1953 EXCAVATIONS)
A
B
C
D
LEGEND
BEDROCK CONTOURS
ELEV OF BEDROCK SURFACE
W WATERWORN ROCK SURFACE
ABCD OLD CHANNELS
SKETCH MAP OF FIVEMILE RAPIDS ARCHAEOLOGICAL SITE (WS-4)
SCALE IN FEET
FIELD SURVEY IN 1955 BY: WILBUR A. DAVIS & DANIEL J. SHEANS
CORRECTED FOR OLD CHANNELS BY: SAMUEL C. SARGENT
TRACED BY: DAVID L. COLE

MAP 7. Sketch map of Fivemile Rapids and sites excavated. Archaeological area showing land surface (1955) and "old channels" of the Columbia River.

site adjacent to the south side of the Celilo Canal. In 1938 this highway was relocated and widened, further destroying an undisturbed area. However, during this construction with the assistance of the Oregon State Highway Commission, the University of Oregon salvaged a considerable amount of valuable material. On the south side of the site close to the cliffs, the Union Pacific Railroad double-track right-of-way cuts straight through the site from east to west. The portion of this site which was excavated in 1952 was a small section on the northern periphery between the canal and the cliffs. It thus was but a small part of what was once an extremely large site, both in depth and in area, and is supposed to have been the main Wasco village. In 1956 the houses of the personnel were removed from the site and an undisturbed area at the east end was excavated. Some excavation was also carried out in undisturbed fill under the original Columbia River highway on the north side of the area.

SITE WS-4 (MAPS 3,* 7, 8, FIGS. 29, 30)

This site lies on the south side of the east end of Fivemile Rapids, between the cliff and the river. The site when we started to work in 1953 bore little resemblance to its condition before the building of the various transportation arteries. Originally, the occupation area extended approximately 125 m. along the face of the cliff which is slightly concave at this area. Fivemile Fault breaks the escarpment at the west end of the site and has permitted some erosion and deposition at this point. At the west end the original surface elevation of the occupation area was approximately 186 feet (57 m.) above sea level. This extended almost level to the river where it ended in a scarp dropping to the channeled lava flows submerged at periods of high water. These ended at the deep, narrow channel of the rapids.

The surface of the site sloped gently slightly east of north so that the elevation at the east was about five meters lower than at the opposite end (map 8). Old photographs indicate this slope continued close to the river bank but above the normal high water level.

On the river side of the site the massive basalt flows were exposed but were partly covered by aeolian sediments and midden debris. Generally, the surface of this basalt was approximately level with the top of the fill at the base of the cliff.

The earlier picture of the area was quite different from the recent. The work of the Corps of Engineers and our own excavations enabled Sargent to map the earlier features of the site. Map 7 shows the "old channels" and the bed rock contours superimposed on the sketch map. This map shows that when the surface of the river was higher, as it was for some time in the Pleistocene (note "water" worn rocks on map 7), it covered this whole area. As its volume declined, the basalt mass split the current permitting a part to flow between it and the cliffs where it eventually became confined to channels, especially channel "A." Channel "C" continued to carry water after "B," but lost its water to "A" because of the rock barrier. No artifacts could be found in channel "C," which was exposed by excavation for the "shoofly," in sharp contrast to the artifact-laden channel "A" showing that it had dried up and filled with sediments before human use of the area. Eventually, as a result of the lowering of the river level, channel "A" became dry except for slack back water in times of annual high water. The direction of this channel, as shown on map 7, indicates how the water had to back into the channel resulting in the sedimentation in the first part of the fill, a subject we shall discuss later. As soon as, or very shortly after, channel "A" no longer carried water, human occupation started. The story of the site, thereafter, is its change by the accumulations of debris of human occupation, drifting sand, and talus eroding down from the enclosing escarpment. No occupation was found at the extreme east end. At Pit 2 (map 8), excavations were down 6.51 m. and, even though occupation continued, work was stopped because of the danger of cave-in. However, the cultural inventory of Pit 2 indicates that occupation there was started much later than in channel "A" and the early occupants were bothered by talus slides and rolling rocks from the cliff. Since U. S. 30 in 1948 used old channel "A" after blasting through the basalt, all the occupational material was lost and it cannot be known whether our site, marked as Roadcut on the map, represented the original point of concentration of use or whether the main use area was in that portion removed in highway relocation.

The modern character of the site reflects the importance of the Columbia River as a transportation artery. Next to the river was The Dalles-Celilo Canal, now submerged by the reservoir. Adjacent to this on the south was the original Columbia River highway to become later U. S. 30. This ran directly over the site and an estimated 3 m. were removed. In 1948, U. S. 30 was relocated by a cut through the basalt and channel "A." Just toward the cliff the Union Pacific Railroad traversed the site through a cut. Shelters for railroad construction workers had been built on the east end of the site in 1910, and debris from this use was embedded in the top of the fill. Part of the site was also used during construction of The Dalles-Celilo Canal (fig. 61). Eventually three dwellings with ancillary buildings for engineering personnel were built on the western edge of the site.

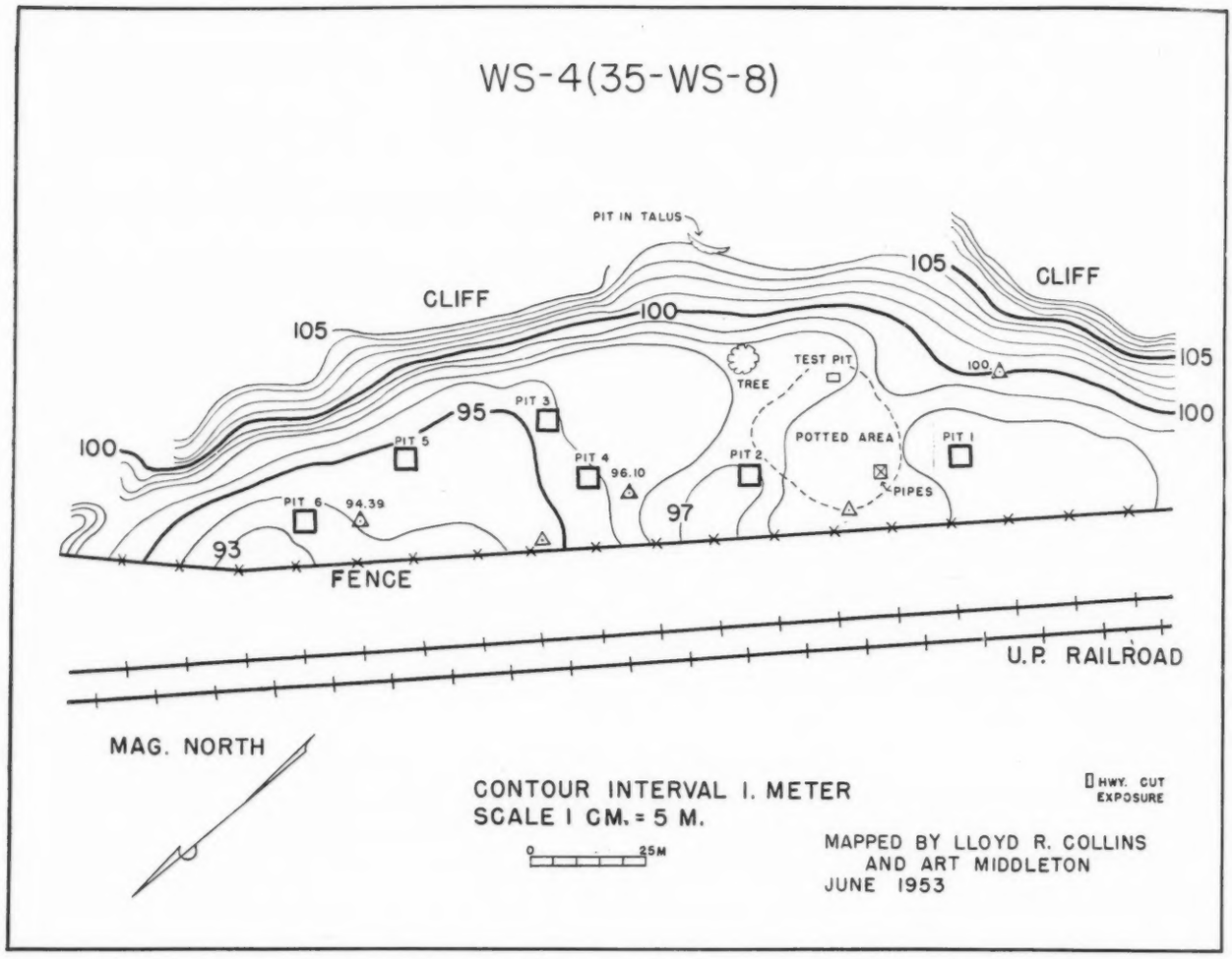
The original nature of the site as a place of habitation is the frame of reference to be kept in mind. The construction work which destroyed the site also made possible the understanding of its original character and something of its subsequent history.

METHODS OF EXCAVATION

WS-1 provided a simple problem in 1952 in the small amount of the original deposit it represented. A trench using 30 cm. levels was cut through the deepest part of the deposit and in 1953, another trench was cut at right angles to the first, forming a T-shaped excavation (map 6). The area excavated in 1956 (map 5) was at the east end of the site and was available after the houses of the personnel had been removed. Landscaping had modified the surface of the small area undisturbed by the earlier housing construction. Mr. John Morton, Project Manager for the Atkinson-Ostrander Company, the contractors, provided a bulldozer and operator to remove the overburden and make preliminary cuts for us. Thereafter, excavation proceeded by the usual trenching methods. Levels were 50 cm. deep.

WS-4 provided difficult problems. Excavation in the area chosen in 1953 (map 8) had to be finished by late August, for relocated U. S. 30 was to be built over it in September. Six strata pits (map 8), each 4 × 4 m. square, were located at points calculated to give samples of the area according to the topography of the site. Pit 1 was in the only level area and between two low exposures of basalt at the west end. It turned out that this pit was located in the old channel "A" (map 7) and gave us the information which eventually led to the discovery of the other part of the site. Pit 2 was east of Pit 1 and located just over the break of the slight slope. Pit 3 was close to the edge of the present talus; Pit 4 was further down the slope and to one side of Pit 2, while 5 was close to the talus on a slight bench and 6 was at the extreme east end.

Each pit was excavated to a different depth depending on local conditions, such as features of the fill, artifact content, time available, and such (figs. 4–9). Methods of excavating varied with the pits. Pit 1 was taken down over the whole surface, then stepped by the 2 m. squares to provide exit for men carrying the dirt. Eventually, we were working a 2 × 2 m. square pit. Pit 2 started out with three of the squares being excavated and holding one to bind the sandy fill. These were then stepped down to a platform onto which the dirt was shoveled from the 2 × 2 m. pit into screens. At a depth of 6.51 m. we could no longer shovel the dirt up to the platform and stopped work in that pit. Furthermore, we were working without shoring and it was too dangerous to continue. The same general



MAP 8. Site plan of WS-4 (35-WS-8) 1953 excavations; facing toward cliff.

techniques were used at the other pits. In Pit 3 burials were found and these were excavated in the usual manner.

Excavation was carried out by 20 cm. levels controlled from an arbitrary bench mark (map 8). All dirt was sifted. Pit 4 was nearly sterile and Pit 6 was sterile and excavation in both was soon stopped.

In Pit 1 at a depth of 2 m., we struck hardpan and after three days of hard digging with a heavy pick, since we had removed only about 0.5 m. of fill, we stopped excavation and moved to Pit 2. In October of 1953 we returned with a party to try to determine the depth of the hardpan in Pit 1 and, if possible, to secure information on the nature and time of its formation. Since it was artifact-bearing and showed no unconformity, it could conceivably serve as a time indicator. Mr. Lloyd Ruff, geologist from the District Office of the Corps of Engineers in Portland, was with us as a consultant. We eventually discovered that the hardpan in Pit 1 was just over 1.0 m. thick. Mr. Ruff continued his field study the next day and discovered the hardpan exposed in the brush-covered surface of the cut made by U. S. 30 when it was relocated in 1948. This part of the site we called "Roadcut."

The vertical depth of the roadcut was approximately 7.8 m. The original Columbia River highway, later U. S. 30, ran over the site, and the shoulder-ditch boundary of the straightened highway of 1948 on the south side abutted against the fill. It would have been preferable if we could have dug straight in from the exposed face of the cut but without adequate scaffolding this was impossible. We had to come down from above and from the back out and so removed the old asphalt road surface with a jackhammer. We built a temporary "fence" across the break of the slope to prevent workers from falling down the face of the cut. Heavy summer tourist traffic and much construction traffic at the dam moved over U. S. 30. Eventually, we got enough fill removed that workers could work in from the slope without much danger.

Excavation was by 20 cm. levels and 2×2 m. squares using the original datum (1953) for leveling, thus having a single series of vertical controls for the whole site. In 1954 we excavated at great labor and very slowly through the hardpan and secured a sample of the artifacts. However, because of the amount of time used in getting through the hardpan, we had only a relatively small exposure horizontally below it, by the end of the season, but we had a sample to the highway level. We also had a good sample of artifacts from above the hardpan. Therefore, in the 1955 season, we rapidly removed the material above the hardpan, except a 1 m. square block removed stratigraphically as a control, to increase the exposure of the horizontal area, and removed the hardpan bed with a jackhammer back nearly to the wall above it. We then concentrated our excavation on the fill which had been under the hardpan (fig. 14) for this was the part richest in archaeological materials; and our area of excavation the previous year had necessarily been limited.

III. GEOLOGICAL STRATIGRAPHY

WS-4, because of the different factors to which the various parts of the site were exposed during its history (pp. 16–17), does not show a uniform stratigraphy. The Roadcut section, although lacking about 3 m. of the top of the original deposit, gives the best record of the nature and order of accumulation of sediments. Oral information from the highway engineers indicated that the removed portion was like that on which it lay. The pit area under the cliff was subject to erosion from the cliffs, slides and probably stream flow in the eastern portion at times of very high water. The Roadcut site, on the other hand, records undisturbed deposition and human use. Here we have, in general from the bottom of the fill, a stratum of silty, quiet water-laid sediments mixed with some occupational debris. This is followed by a stratum which is aeolian in origin with some silt probably washed down from the sides of the channel. Resting

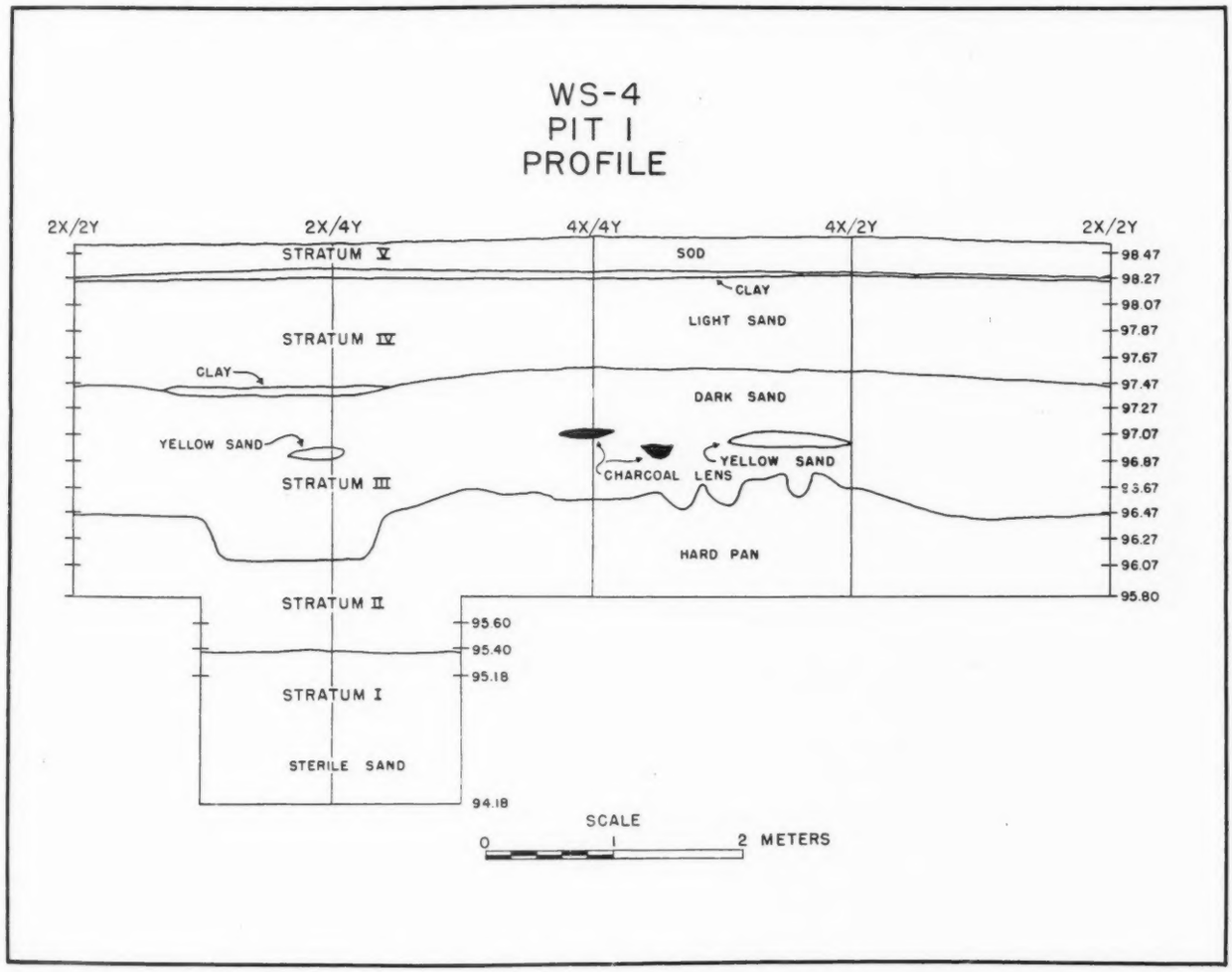


FIG. 4. Pit 1, stratigraphic section.

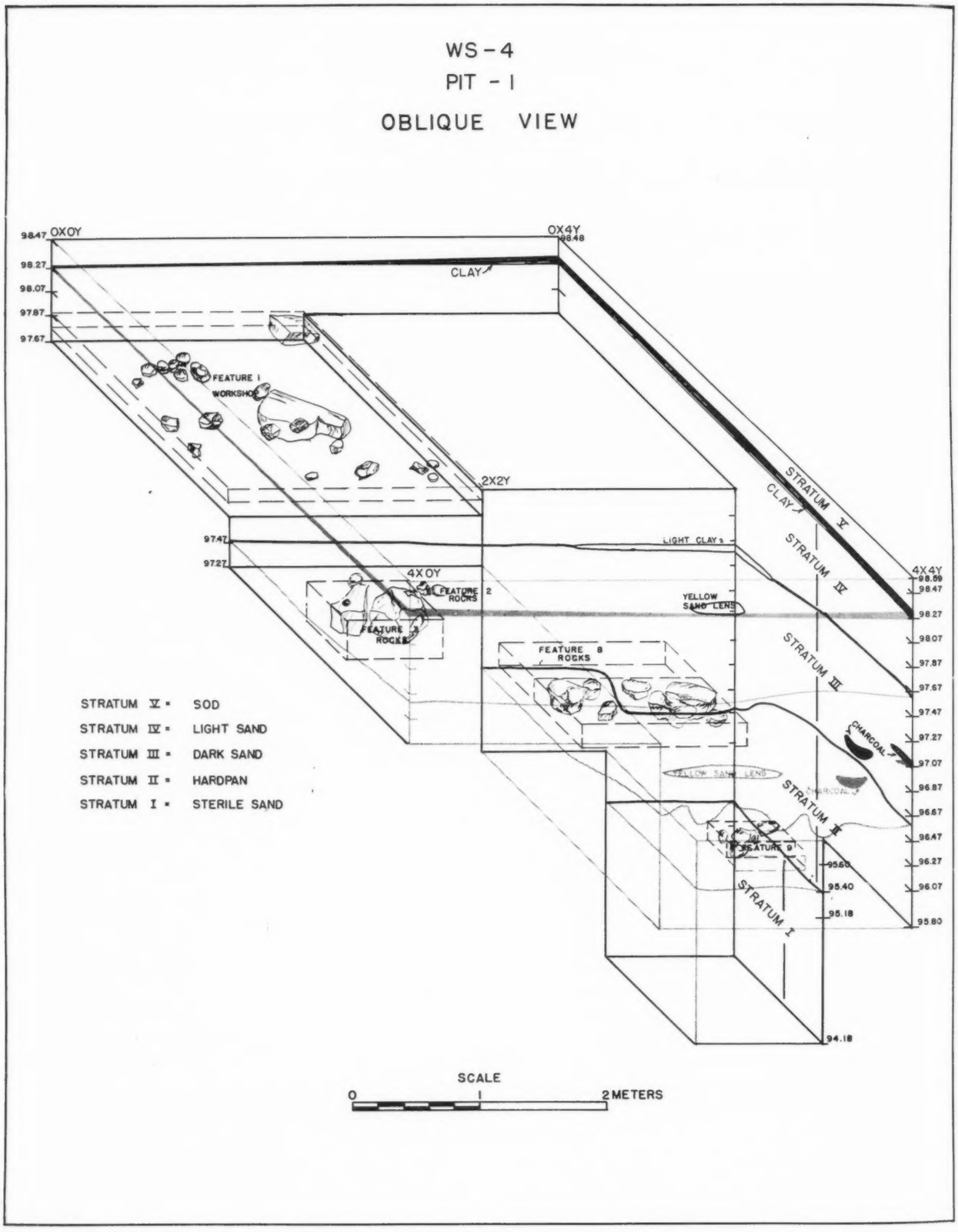


FIG. 5. Pit 1, oblique view.

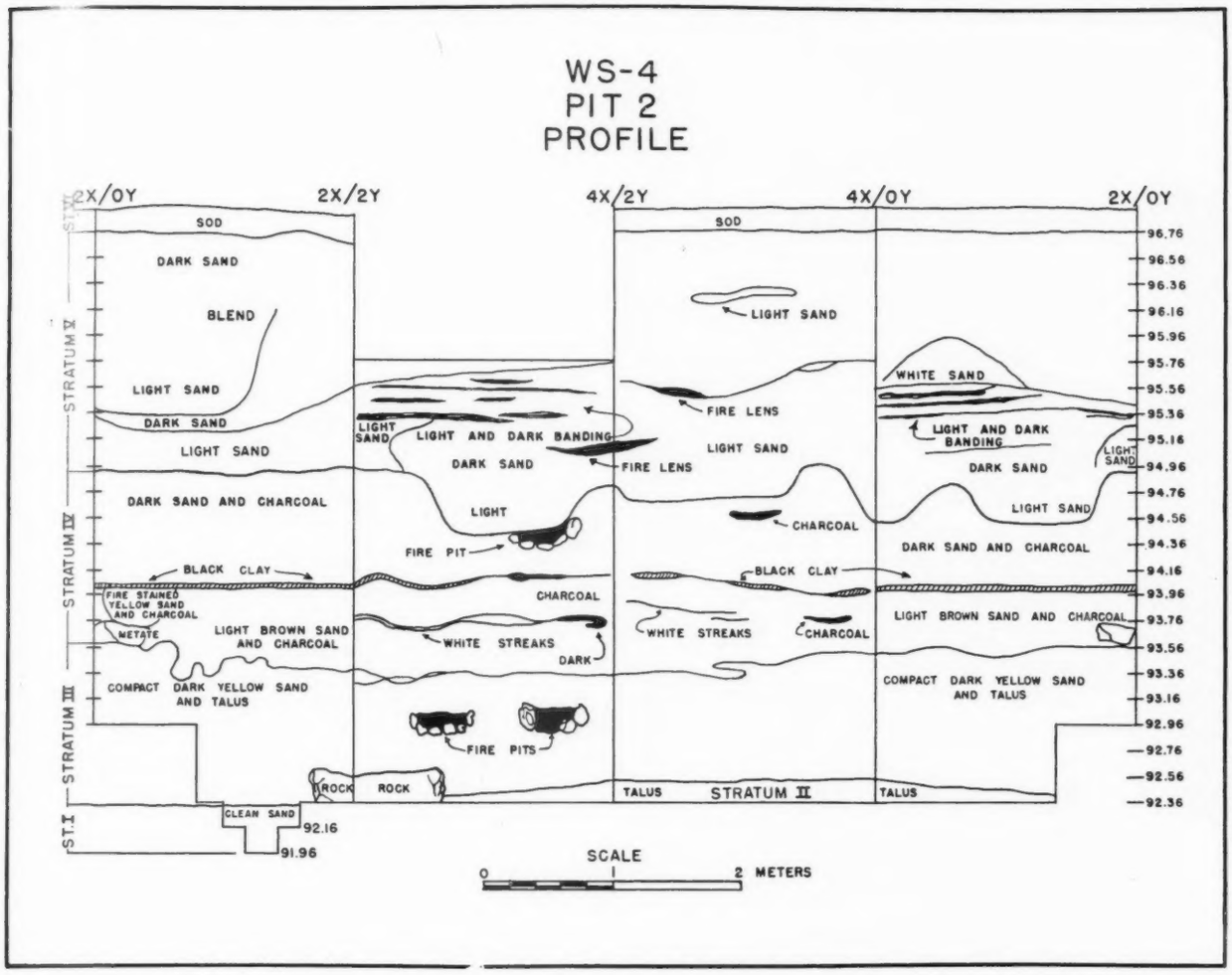


FIG. 6. Pit 2, stratigraphic section.

on this is a bed of cross-bedded aeolian-derived sands. Geologically this derivational character of the deposits continues to the top. However, a bed of hardpan of varying thickness rests on the cross-bedded stratum. On the hardpan there is a stratum of red to yellowish tan sand. A talus wedge of flat, approximately hand-sized pieces of basalt extends on to the top of this level at the east side but is almost certainly an artifact while finally there is a stratum of fine brown sand resting on the yellowish tan with the bedding between them quite distinct.

There are two characteristics of the stratigraphy which require discussion. First is the obvious downfolding in the fill, and second is the origin and date of the hardpan formation. We shall discuss these in that order.

As we have pointed out above (p. 17), the site is in an originally V-shaped channel in the basalt (map 7, A), and the general appearance suggests that there was a large pothole here where the channel makes a bend to the west. A pothole was exposed in channel C (map 7). Water backed into the channel in the early days of its use and run-off from the cliff above also seeped into the fill. There were probably springs which may have been a source of seepage water along the cliff. At any rate, sometime late in the history of the use of the site, settling of the fill took place along the axis of the channel; that is, compression took place because of loss of volume, probably owing to moisture loss, and weight of the fill. The sides of the channel were resistant and served as anchor points while the fill settled along the line of the lowest part of the channel. Figures 14–16, profiles along the 6Y, 10Y, and 12Y axes, and figure 32 clearly indicate the downfolding. That the settling occurred late in the history of the site is clearly shown in figure 32 at the upper left hand corner at point 0X/12Y where the talus wedge and the charcoal dip sharply downward. A line

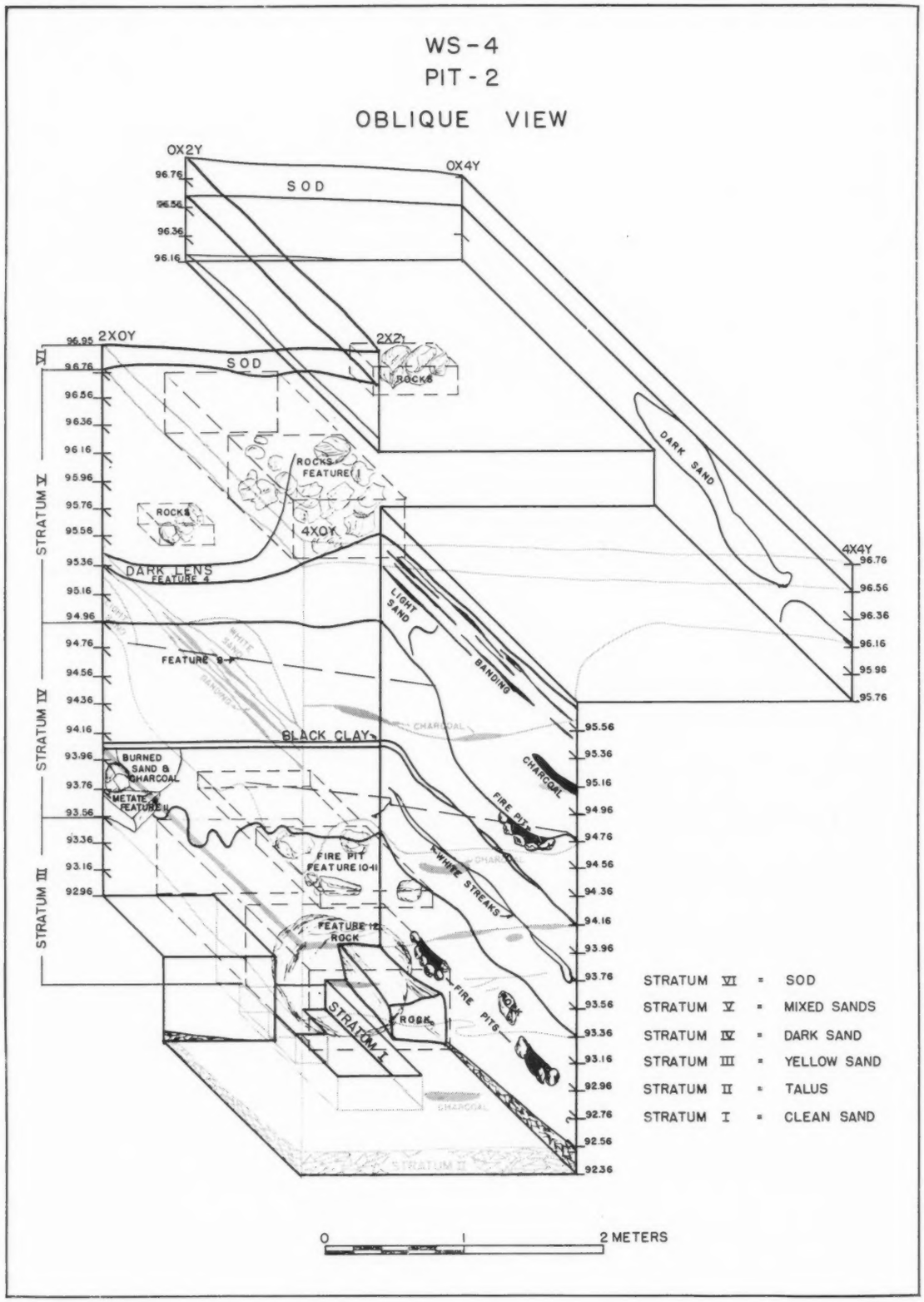


FIG. 7. Pit 2, oblique view.

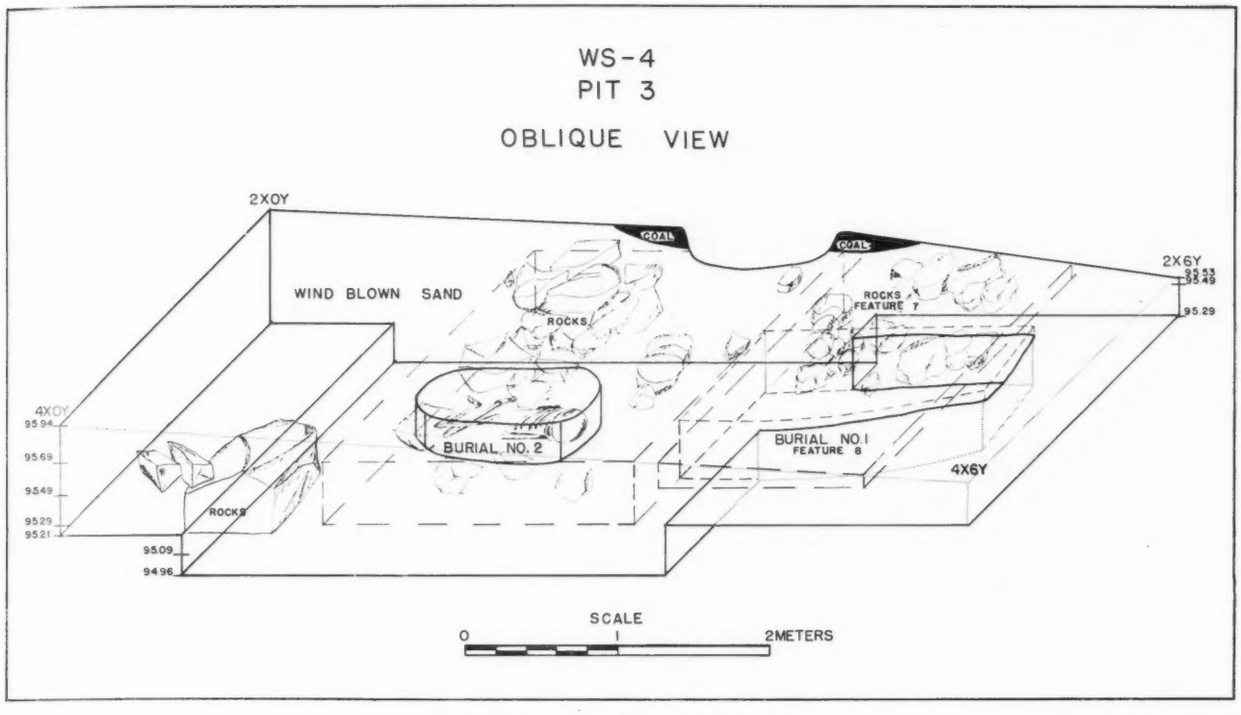


FIG. 8. Pit 3, burials; oblique view.

drawn from the bottom of excavation at the faces 12X/0Y to 0X/12Y on figure 32 corresponds to the axis of the greatest depth of the downfold.

This settling made necessary adjustment of the stratigraphic records controlled by arbitrary levels. This was done by establishing the original level of the fill from the side measurements where settling had not occurred. The profiles are drawn as the stratigraphy was observed. However, cultural data are adjusted to the original conditions of the sites as are the delimitations of the strata to the arbitrary levels used to define them as described below.

The hardpan stratum was formed before the settling took place as is shown by the crack patterns it contains. Had that not been the case there would have been settling but no cracking. The hardpan was formed by cementation by an opalite material carried in solution. The depth of the hardpan is greatest on the sides of the fill close to the rocks. After the settling and cracking took place the cementation continued for small fins of opalite filled some of the cracks with sufficient hardness that the surrounding dirt could be readily brushed away leaving the finlike deposit projecting above the enclosing fill. At approximately the 8X axis the stratum was thinnest and in spots considerably softer than elsewhere. Figure 32 shows the massive character of this stratum. The student holding the stadia rod is standing on the top of the hardpan, and the bottom is at the stake at the upper end of the wall built up of the large blocks broken out of the bed. The bottom of the stratum then rises and levels off at the top of the lower stadia rod and extends in a slightly up-sloping plane to the west side of the excavation.

While C-14 dates bracket the hardpan, they must not be thought of as dating it. Since the stratum is artifact-bearing, hardpan had to be formed at some date later than the occupation, the date of which is included in the brackets of C-14 dates. These C-14 dates simply serve as convenient chronological referents with the younger one marking the incidence of new cultural activity. The detailed description of the geological stratigraphic section read from the bottom up is as follows:

ROADCUT

Stratum I—Level 31 down. Silty clay to clayey silt deposited in slack water; occupational debris which becomes heavier toward top, consists of stone, bone, and antler artifacts; animal, fish, and bird bones; gastropods (*cf.* Appendix A); carbon bands formed by decomposed organic matter such as drift and tules and grasses growing on wet earth as at present after high water has gone down from the sloughs along the river. C-14 date, a composite for the entire stratum, 9785 ± 220. (Barendsen, G. W., *et al.*, 1957: 908.)

Stratum II—Levels 25–30. Sand and occupational debris with small amount of silt probably deposited by erosion from sides of the channel; no evidence of duning; heavy concentration of wide range of artifacts; great numbers of fish bones, bird and animal bones continue but decline in numbers in upper levels; *Coragyps occidentalis* found in

Level 28. C-14 date, a composite for stratum, is 7675 ± 100. (*Ibid.*)

Stratum III—Levels 22–24. Fill is mostly sand of aeolian origin; cross-bedding is marked for first time, artifacts and bones decrease in number. C-14 date, sample from level 23, including 20 cm., is 7875 ± 100. (*Ibid.*) This stratum on the basis of origin and depositional character belongs to the overlying one which now is hardpan. Near the top was a thin band of volcanic ash, almost pure glass fragments, *cf.* fig. 12, "White Band" indication; compare p. 29, WS-1, Stratum II.

Stratum IV—Levels 11–21. Aeolian-derived sand and some occupation debris later cemented by opalite-like solution; top is fairly uniform in elevation but bottom is irregular and difficult to determine conclusively where soft areas occur as at 8X described above; artifact concentration about same as in Stratum III; animal bones cease; last fish bones in level 19, birds and mammals in 20.

Stratum V—Levels 5–10. Light tan aeolian-derived sand containing high concentration of artifacts. Wedge of talus intrudes into part of this stratum from 0X to 9X; general uniformity of size of pieces and the included artifacts with no source known for a talus slope to account for this suggests that the intrusion is artifactual.

Stratum VI—from Level 1 through 4. Dark brown to reddish sand with many artifacts, charcoal and occupational debris.

THE PIT AREA

The considerable amount of diversity found among the stratigraphic manifestations of the pits demonstrates a lack of homogeneous deposition throughout this portion of the site. However, in some cases correlations can be made in the more recent strata. The following description is drawn mostly from that made by Mr. Cole in his master's thesis in 1954. The strata are numbered from bottom to the top.

Pit 1 shows five clearly defined strata (fig. 4), and the stratigraphy and included features are shown in figure 5 in oblique plan.

Stratum I was a gray sand containing a few water-worn cobbles; no artifacts were found in the small test pit dug to a depth of 1 m. below the hardpan but the sample excavated was too small to be reliable.

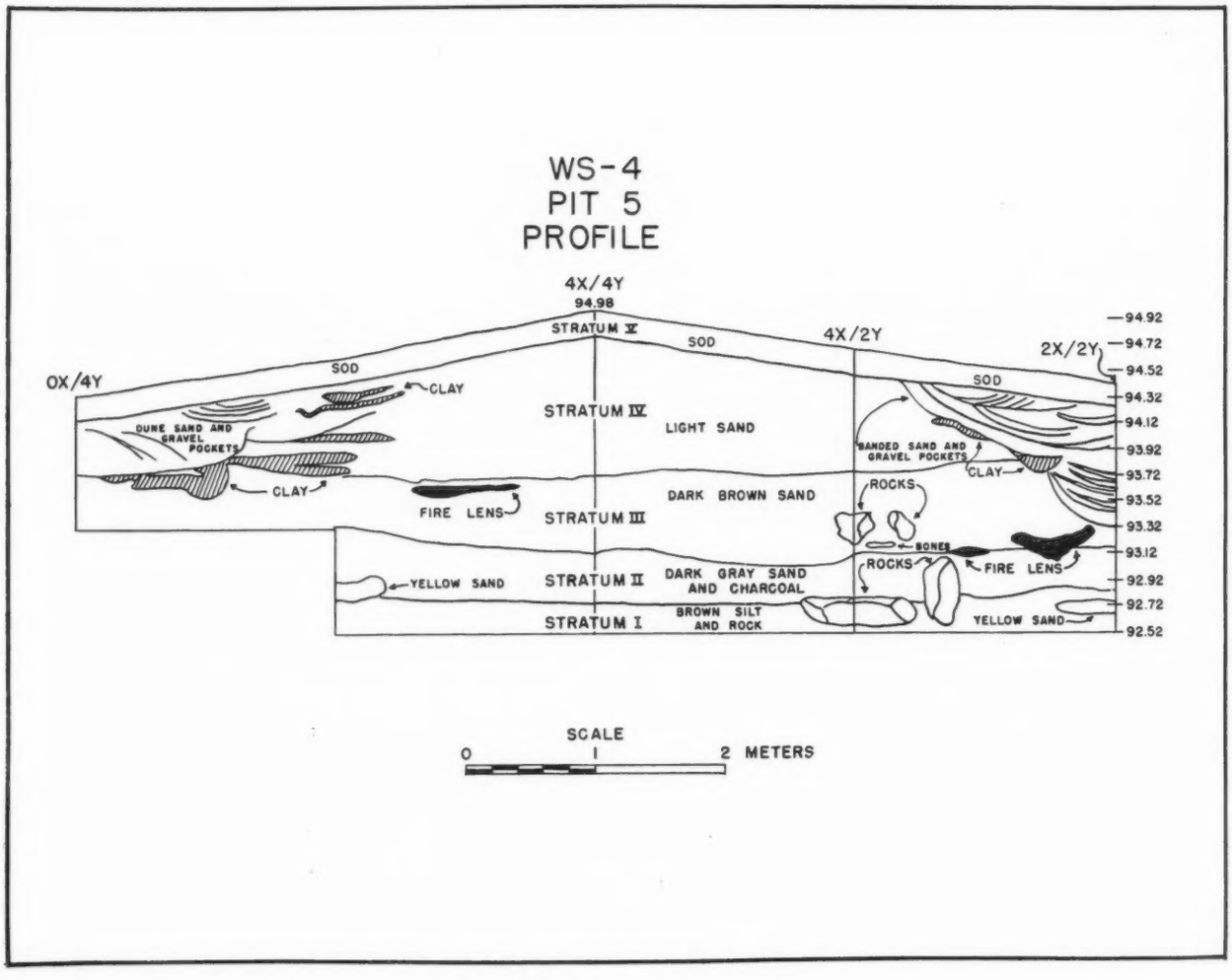


FIG. 9. Pit 5, stratigraphic section.

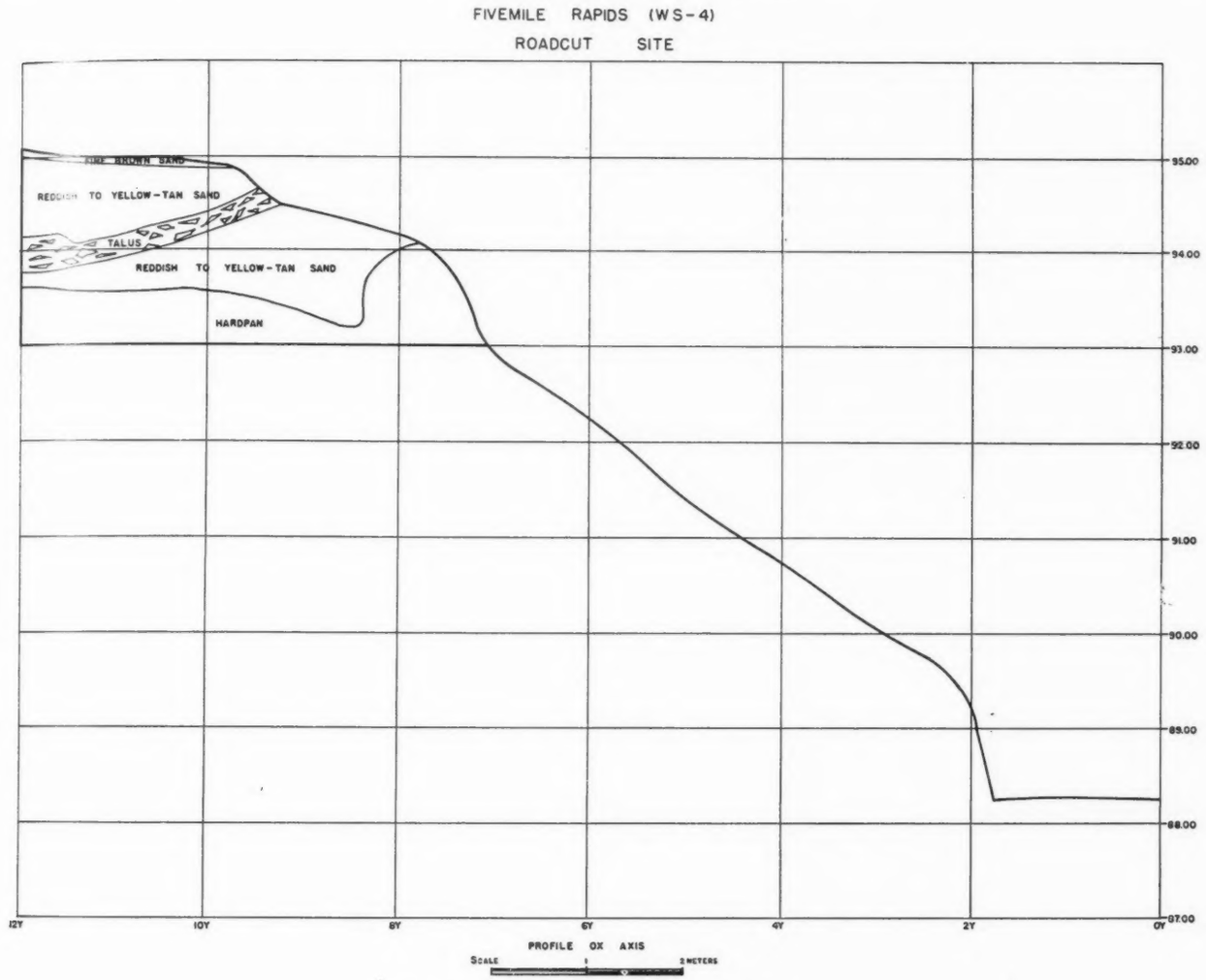


FIG. 10. Profile—0X axis, WS-4, Roadcut.

Stratum II was hardpan, a cemented yellow to red-orange colored sand (hardpan) with an irregular upper surface. The thickness was 119 to 127 cm.; much angular basalt was included. This formation was a part of the hardpan formation found later in the Roadcut.

Stratum III was sand stained by organic matter to a darker color than the overlying bed. It varied in thickness from 80 to 100 cm. A light-colored clay lens about 6 cm. thick extended into one corner of the pit. Angular basalt fragments and large rocks were found throughout except in the clay lens.

Stratum IV was light-colored windblown sand and fairly uniform both in color and deposition. It was about 5 cm. thick, from 70 to 75 cm.

Stratum V consisted of windblown sand mixed with grass and roots. It included a number of thin bands of clay intercalated with sand and fine gravels washed from the cliff and impounded in small pondlike features.

Pit 2 contained 6 strata (figs. 6, 7).

Stratum I was a wet gray sand layer containing a few water-worn pebbles and artifacts. It was the bottom 40 cm. of the pit, so its actual depth is unknown since excavation was not carried further.

Stratum II was a wedge of talus mixed with coarse yellow sand. It was 18 to 20 cm. thick along the 4X axis but did not extend across to the 2X axis. It obviously represented a slide or wash from the cliff. This fill was quite moist.

Stratum III was fairly homogeneous, 80 to 100 cm. thick consisting of a dark yellow sand mixed with heavy concentrations of angular basalt. The top of this stratum was extremely irregular. In the top 60 to 70 cm. of Stratum IV, extending into the bottom of Stratum III was a large boulder 80 cm. long, 70 high, and 50 wide which rested on a charcoal lens. The rock had come from the cliff above.

Stratum IV was a dark brown sand 80 to 120 cm. thick containing much angular basalt and charcoal. The top of this stratum was trough-shaped, with a depression 1 m. wide running diagonally across the pit. The sides of this trough rose from 40 to 45 cm. above the bottom. From all appearances, the trough seemed to be a man-made depression. A fairly level deposit of dark clay or silt 4 cm. thick occurred 2.7 m. below the surface, continuous over the

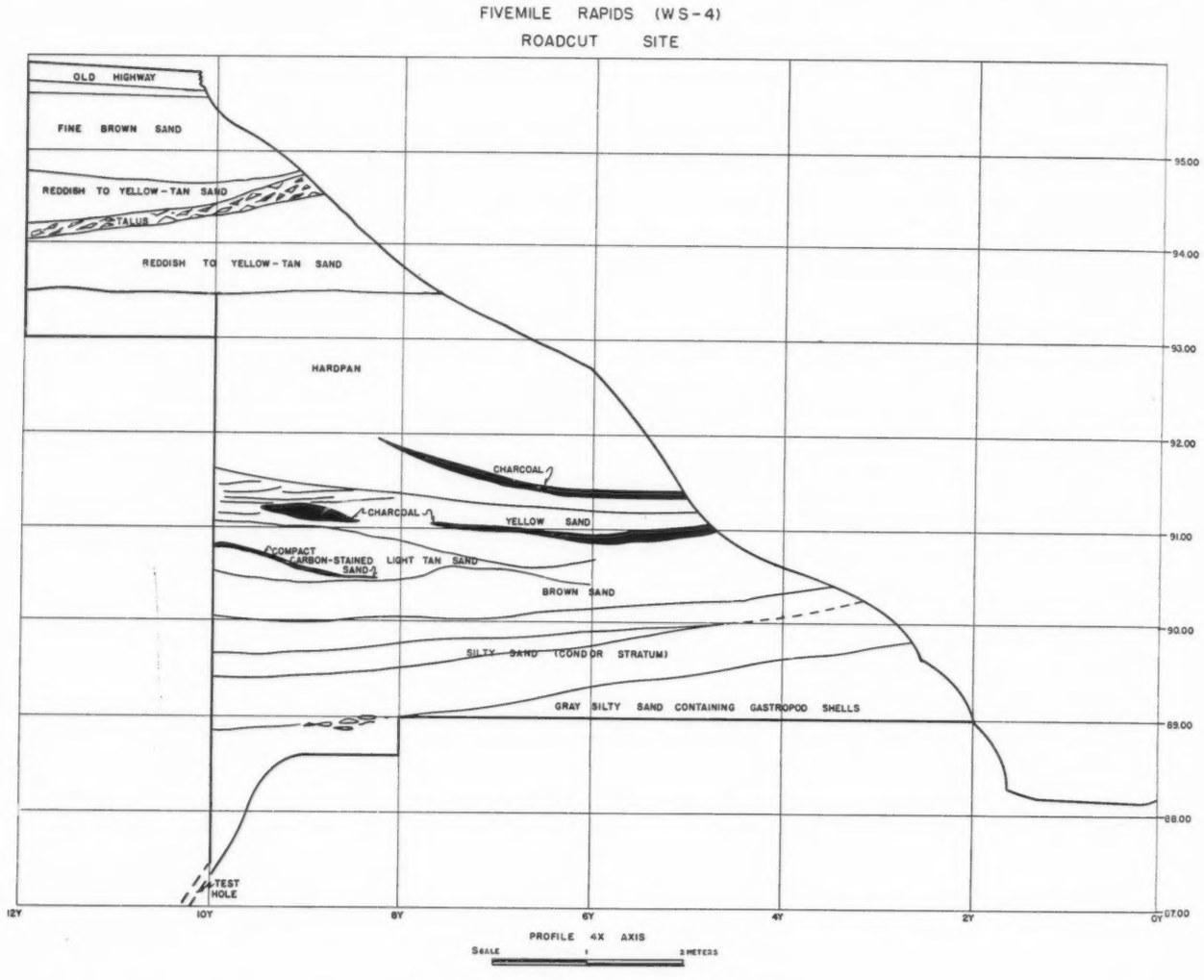


FIG. 11. Profile—4X axis, WS-4, Roadcut.

whole 2 m. section, but varying in evenness and thickness along the 4X axis. This silt may possibly be correlated with a high flood stage of the river. Below this dark layer the stratum was slightly lighter than above it, but the nature of the deposition remained the same. In this part of the stratum there were white streaks, 1 mm. thick, along the 2X and 4X axes. These correspond to similar features observed at WS-1 and Wakemap and probably represent bleached grasses or reeds.

Stratum V was not homogeneous. It consisted for the most part of windblown sand and contained very little rock except in three clusters, two of which extended down from Stratum VI. One contained three rocks 16 to 20 cm. long, while the other was a pile of 50 rocks 4 to 25 cm. long that extended 40 cm. into Stratum II. The sand at the top of this stratum was fairly dark, and continued so for 80 to 120 cm. where it began to blend into a lighter sand. Figure 6 shows bands of light- and dark-colored fill measuring 1 to 8 cm. thick. One of these bands was quite compact and had a distinct fishy odor. There were no clear-cut lines of differentiation between these described characteristics except in the case of the dark sand layer. Otherwise the differences between the lighter and darker sands were barely enough to detect.

Stratum VI was a sod layer with intermixed grass and roots, 20 to 30 cm.

Pit 3 (fig. 8) was dug to verify the cremation-burial stratigraphy and represents only cultural stratigraphy within the top sand level of the site.

Pit 4 was 40 cm. deep and entirely in gray, windblown sand and culturally sterile.

Pit 5 (fig. 9) contained 5 strata, was dug into the slope, and varied from 2.40 to 2.1 m. in depth to the bottom of excavation.

Stratum I—the bottom 28 cm. of the excavation consisting mostly of brown compact silt with some inclusions of sand pockets.

Stratum II—gray sand 40 to 50 cm. deep darkening towards the bottom, and containing much angular basalt, charcoal, and a few pockets of coarse sand.

Stratum III—a layer of dark brown sand 40 to 50 cm. thick, level and fairly uniform, although it contained a few large rocks and bits of angular basalt. Stratum III is not too sharply differentiated from IV, and may be a continuation of it. The differences are slight ones of color.

Stratum IV—a mixture of clay lenses, gravel pockets, light brown sand, and a darker brown sand. It varied from 120 cm. in depth at the highest part of the slope to 40 cm. at the lowest. In the deepest portion, the stratum was a continuous deposit of brown sand. At that part of the stratum, about 80 cm. thick, began layers of varicolored sands apparently banded, pockets of gravels, the largest of which was 30 cm. wide by 10 cm. deep, clay deposits from 4 to 10 cm., level on top, though often irregular on the bottom. The nature of this deposition suggests that at one time the bank had been washed away, as shown by the uniformity in the brown sand layer in the higher section, then the holes filled with larger gravels and an obstruction built up inhibiting the current so that clay was deposited in still water. Subsequently windblown sands were deposited over the fill in the washed out area accounting for the concave appearance of the bands of sand.

Stratum V—a layer of sod, grass roots, and windblown sand about 20 cm. thick over the entire area of excavation.

Pit 6 consisted of 60 cm. of white windblown sands culturally sterile. Test pit excavated May 22–23, 1953.

Stratum I—sterile red clay.

Stratum II—large boulders covered with silt and containing artifacts and bits of fish bones.

Stratum III—a fine light-colored sand with many flakes and no rocks.

Stratum IV—a considerable amount of rock mixed with a yellow sand and a few artifacts.

Stratum V—a compact, wet sand, with many small rocks (6–8 cm.).

Stratum VI—light sand firmly packed containing many large basalt rocks 15 to 20 cm. in length of the same material found on the talus slope.

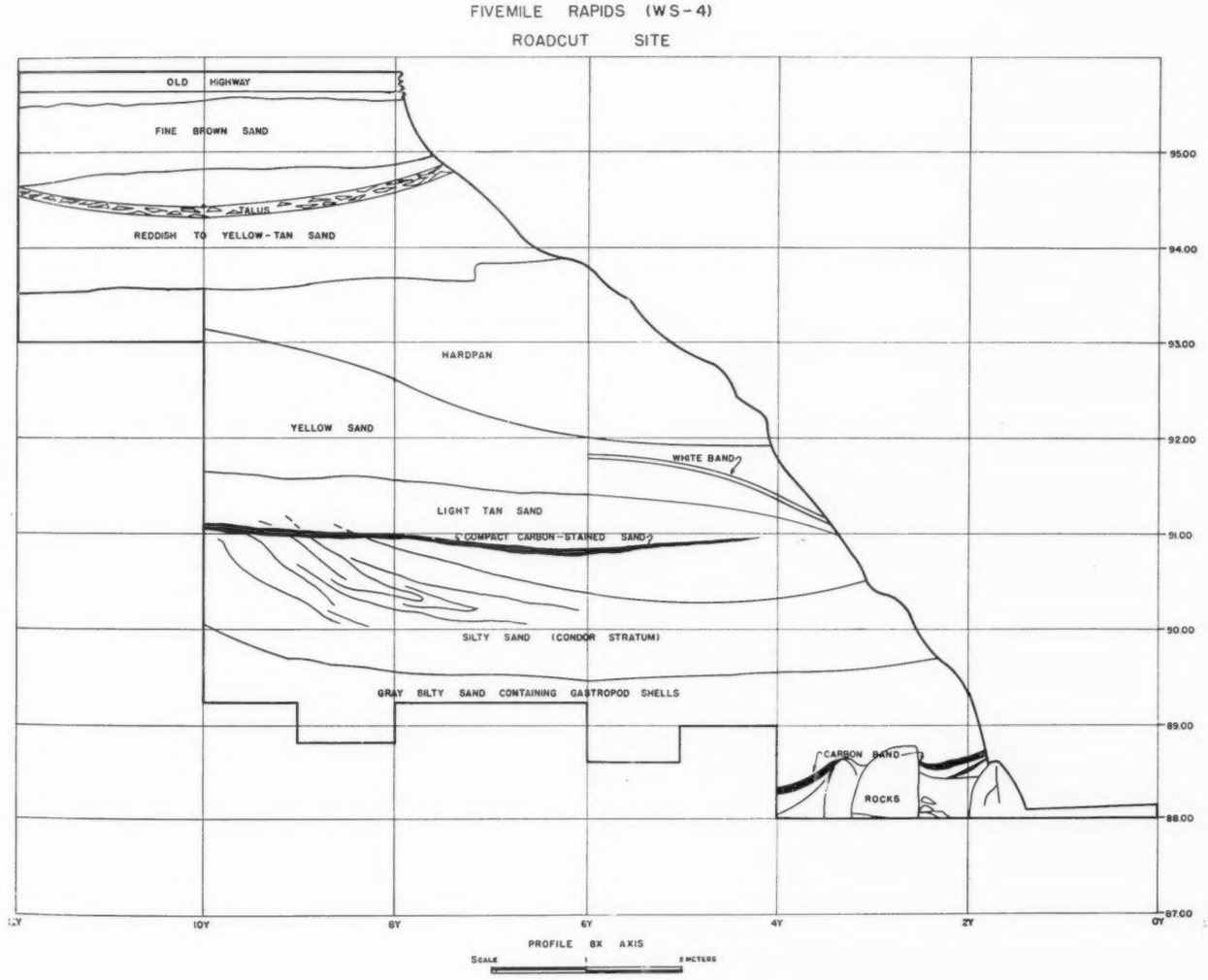


FIG. 12. Profile—8X axis, WS-4, Roadcut.

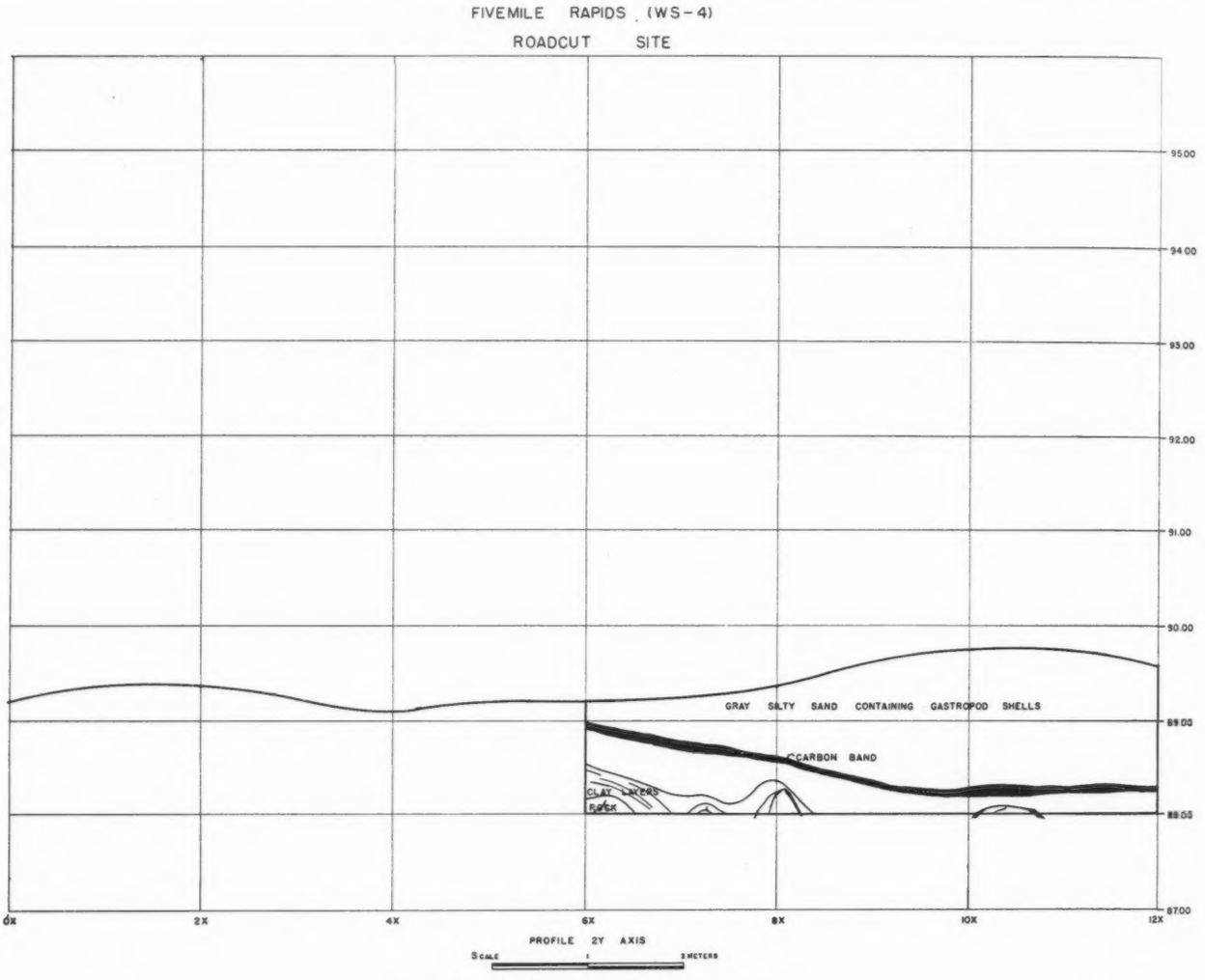


FIG. 13. Profile—2Y axis, WS-4, Roadcut.

Stratum VII—similar to that just mentioned, but the sand was yellow.

Stratum VIII—a layer of tar (*cf.* explanation below), 7 cm. thick on a bed of fine sand which extended to a depth of 42 cm. and contained burned human bones, fire cracked rock, flakes and artifacts.

The appearance of tar in the top of the test pit, pieces of broken stoves, roofing nails and caps usually used in fastening tar paper, and similar debris at various places in the top level of WS-4 indicated the former presence of some kind of building. I wrote Mr. D. J. Callahan, General Tax and Right of Way Agent for the Union Pacific Railroad Company, August 11, 1953, asking whether there had ever been any use of the site by the Company. Mr. Callahan replied September 8, 1953, as follows:

In 1910 and 1911 the Union Pacific Company relocated, reconstructed and double-tracked its main line between The Dalles and Deschutes River. Touhy Bros. were the contractors performing the work. Mr. C. S. Spencer, who is now our Assistant Land and Tax Agent, was a chainman in the engineering crew which was camped at Seuferts and which supervised the reconstruction of the railroad in 1910 and 1911. He remembers that when the line was reconstructed between Five Mile Creek and Big Eddy at one location the contractors uncovered a number of Indian stone pots and pestles and a large number of Indian arrowheads and spearheads varying in size from about one-half inch in length and one-quarter inch in width to about four and one-half inches in length and one and one-half inches in width; that the Engineer in charge of the work, Mr. O. Winningstad, who is now deceased, was of the opinion that this was an ancient Indian burying ground and that the relics, which were unearthed, should be placed in some museum. However, we have no record of what became of these Indian relics.

The contractors did have a temporary warehouse for the storage of equipment and materials, which was probably 50 feet in length by about 30 feet in width with a tar-paper roof. The stone pits which you mention were probably the

ones which the contractors used for the melting of tar in order to make the roof waterproof. At one point on the cliff approximately opposite the location where the relics were unearthed there were a few faint markings; some of yellowish nature and some of a brownish nature, which Mr. Winningstad thought were Indian hieroglyphics. We do not know whether these markings still exist, as they were so faint in 1910 that they would not be noticed without careful search.[1]

[1] During the summer of 1959 Mr. David Cole, in charge of our field party farther east in the John Day Dam reservoir area of the Columbia River, re-examined the pits referred to above. One of them had been pulled apart and deeply excavated by collectors. In the debris was a great deal of evidence of cremation. It seems then that the correct sequence of the use of these pits is that they were first used as cremation pits and abandoned; then talus from the cliff above accumulated in them; next the construction crew, perhaps nearly a century later, reconstructed them for their use by filling in the hole with rocks to the desired depth and building a high surrounding lip. They were then used for melting tar.

WS-1 (fig. 17)

The stratigraphic section of the 1956 excavations is as follows:

Stratum I—grayish brown silty clay from water table down.

Stratum II—loose extremely moist dark gray coarse sand containing very little rock, silt increased in proportion toward the bottom of the stratum; volcanic ash, almost pure glass fragments, about 5 cm. deep, aerial deposition and original deposit.

Stratum III—yellow to orange colored very compact earth varying to a hardpan in places; many basalt fragments and river cobbles included, the latter certainly brought in by the occupants; cementation and staining possibly due to the chemical action of minerals in the included rocks and occupational debris such as bone material; drainage from nearby springs probably contributed to diversification of this stratum.

Stratum IV—dark organically stained earth with heavy concentrations of angular basalt fragments.

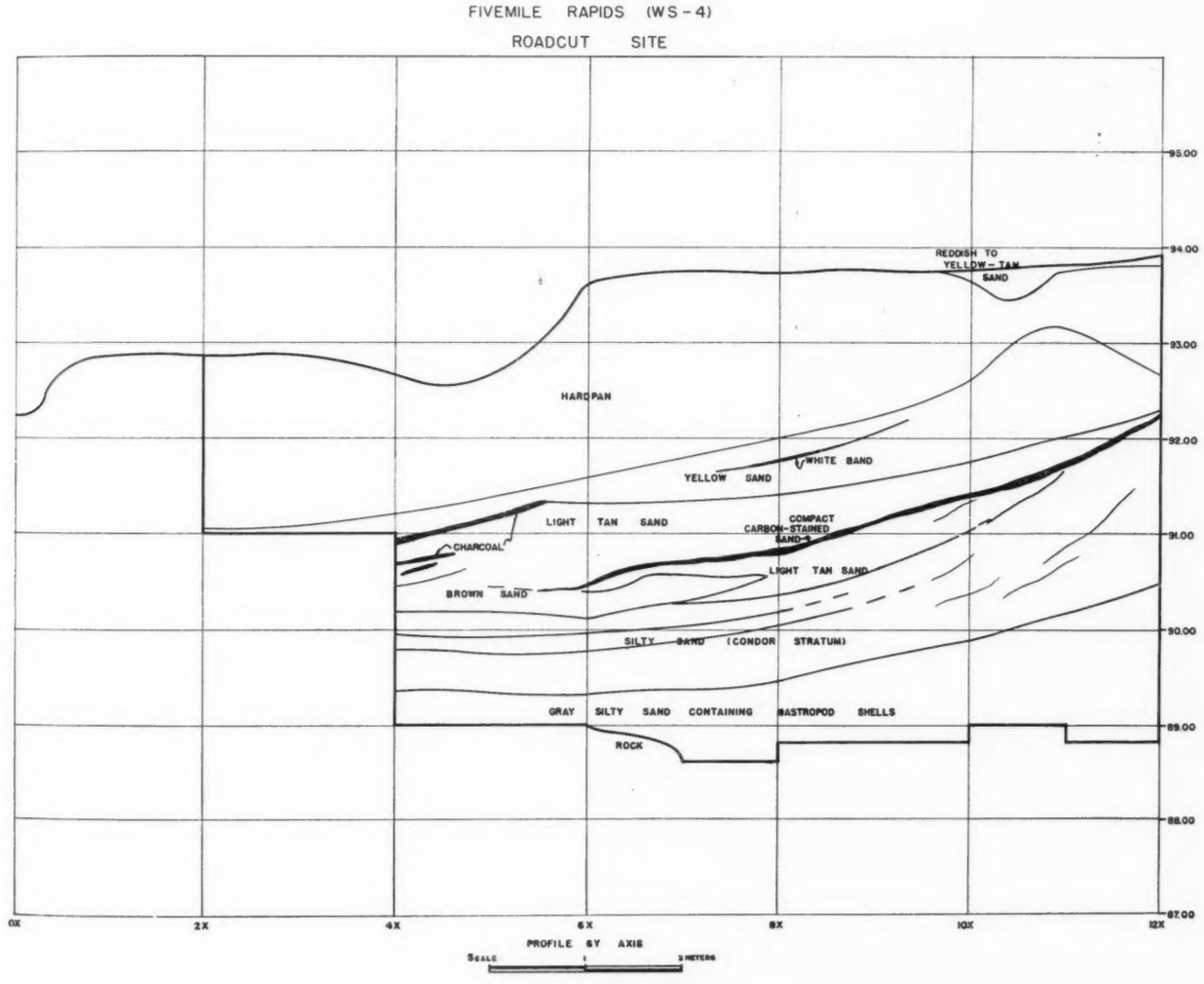


FIG. 14. Profile—6Y axis, WS-4, Roadcut.

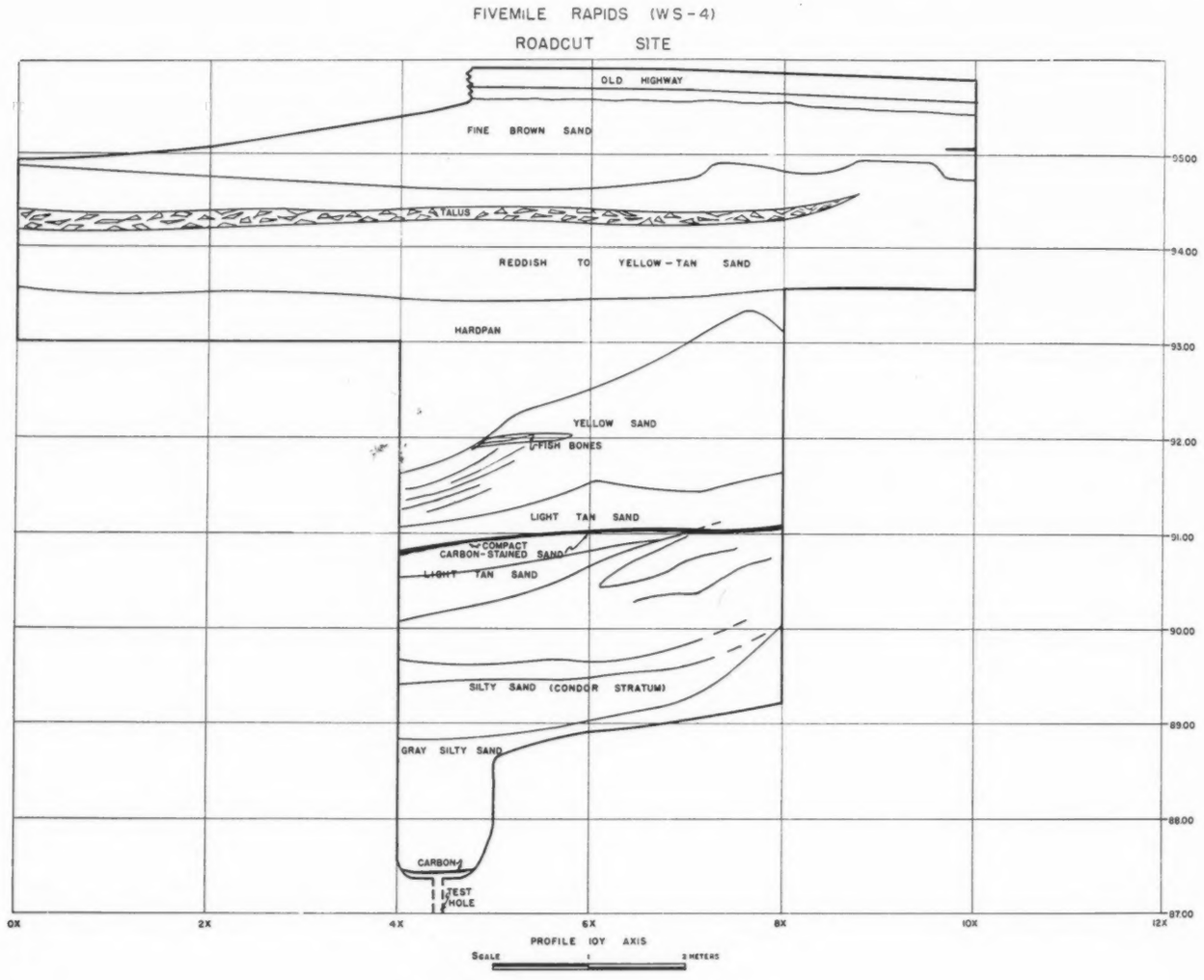


FIG. 15. Profile—10Y axis, WS-4, Roadcut.

Stratum V—a light brown sand to loam deposit with much weathered basalt included.

Stratum VI—dark brown powdery loam with no included rock. The stain is probably due to percolating surface water. This stratum continued into the sod of the landscaped surface.

The area excavated across the abandoned U. S. 30 showed the same depositional character as Stratum V. The same is true for the deposit which was excavated in highway relocation in 1938. The original part of the excavations in 1952 and 1953 just inside the cliff at the river were in the same kind of fill as just described although there was some differentiating stain due to occupation. Stratigraphically these parts of the site would represent late to terminal occupation; the cultural manifestations confirm this deduction.

IV. ETHNOHISTORICAL SETTING

Little is known ethnographically of the Indians who occupied both banks of the Columbia River in the Fivemile Rapids area. Decimated by the epidemic diseases which ravaged the Indians of the Columbia River region in the last quarter of the eighteenth century and the first quarter of the last century, displaced, and their culture broken by white migration of the 1840's and 1850's, they signed treaties with the United States Government in 1855 and this date can be used as the effective termination of the aboriginal way of life. However, for all practical purposes, the old way of life was gone well before that.

The earliest records of the area are those of the Lewis and Clark Expedition which passed down river through the Fivemile Rapids late in 1805 to return the

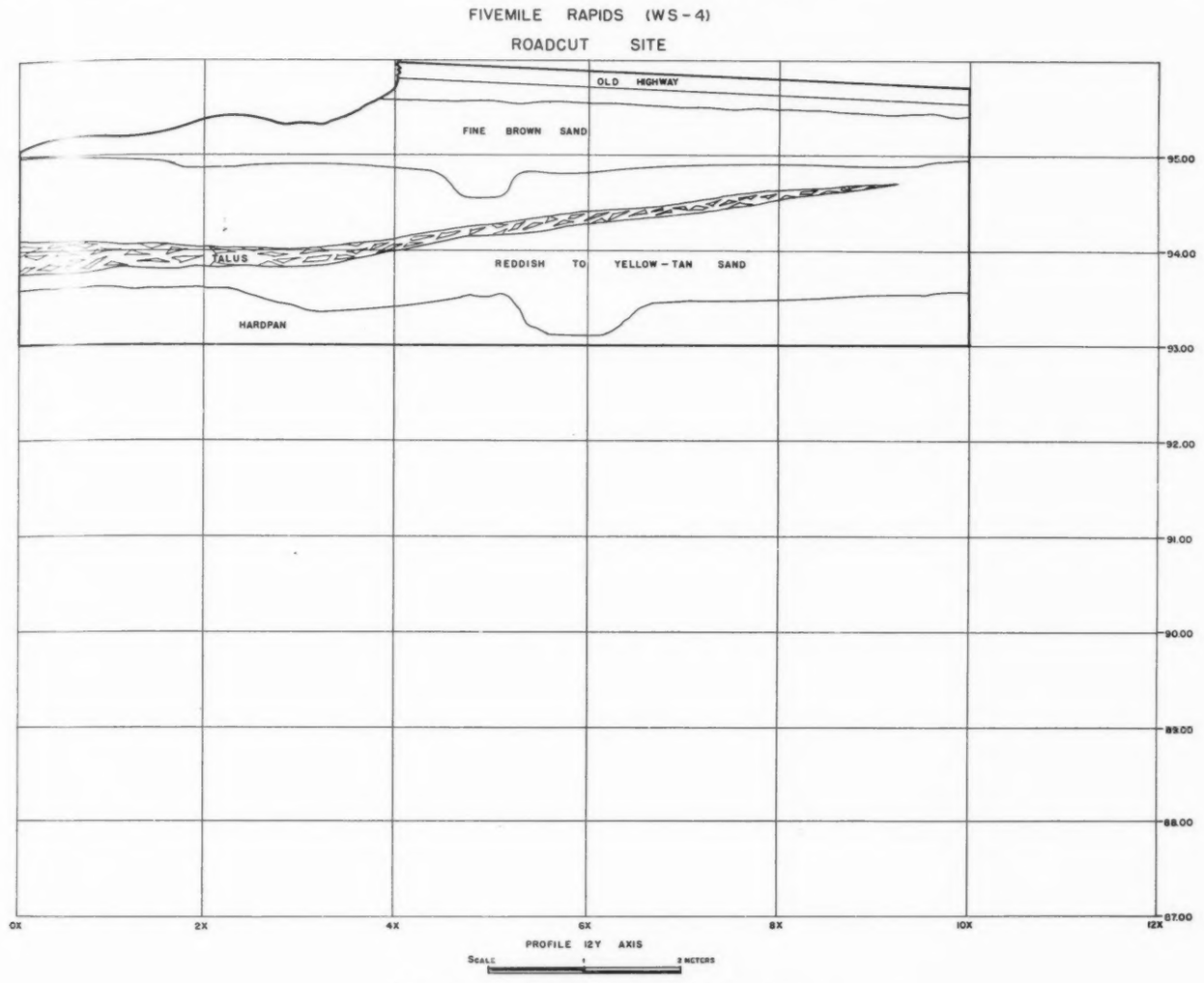


FIG. 16. Profile—12Y axis, WS-4, Roadcut.

next spring. Curiously enough the explorers reported that they saw no habitations in this area on the Oregon side and they were told by the Indians on the Washington shore that the Oregon side had been abandoned as a result of the pressure of Snake raids. In view of the archaeological deposits the lack of evidence of population on the Oregon shore is difficult to explain. However, it was easy for the river Indians with their mastery of the canoe to cross the river as well as move up and down, and temporary absence may have been mistaken for abandonment. Other explorers and fur traders have added briefly to our knowledge of the Indians of this area but for ethnographic data the records are scanty.

The best source of information is the paper by Spier and Sapir (1931) on the basis of data secured from Wishram informants living on the Yakima reservation in Washington, and it is on this source that we shall draw as a reference.

The Wishram, generally accepted as the "Echeloot" of Lewis and Clark, "together with the allied Wasco, occupying the opposite bank of the Columbia were the easternmost of the Chinookan tribe on the River" (p. 159). The Chinookan language, divided into Upper and Lower Chinook, extended along both sides of the river to the Pacific Ocean and north and south some distance along the coast, where in each case it came into contact with coast Salish-speaking stocks. The dialect spoken by the eastern Chinookan groups extended approximately to the Cascades on the south bank of the Columbia but further west on the north side.

It has generally been assumed that what was true of the Wishram was true of the Wasco because they were neighbors, and spoke the same dialect, even if on opposite sides of the river. Whether this assumption is valid is not and cannot be known, but in the absence of information to the contrary it can be accepted as a working hypothesis. However, in view of the archae-

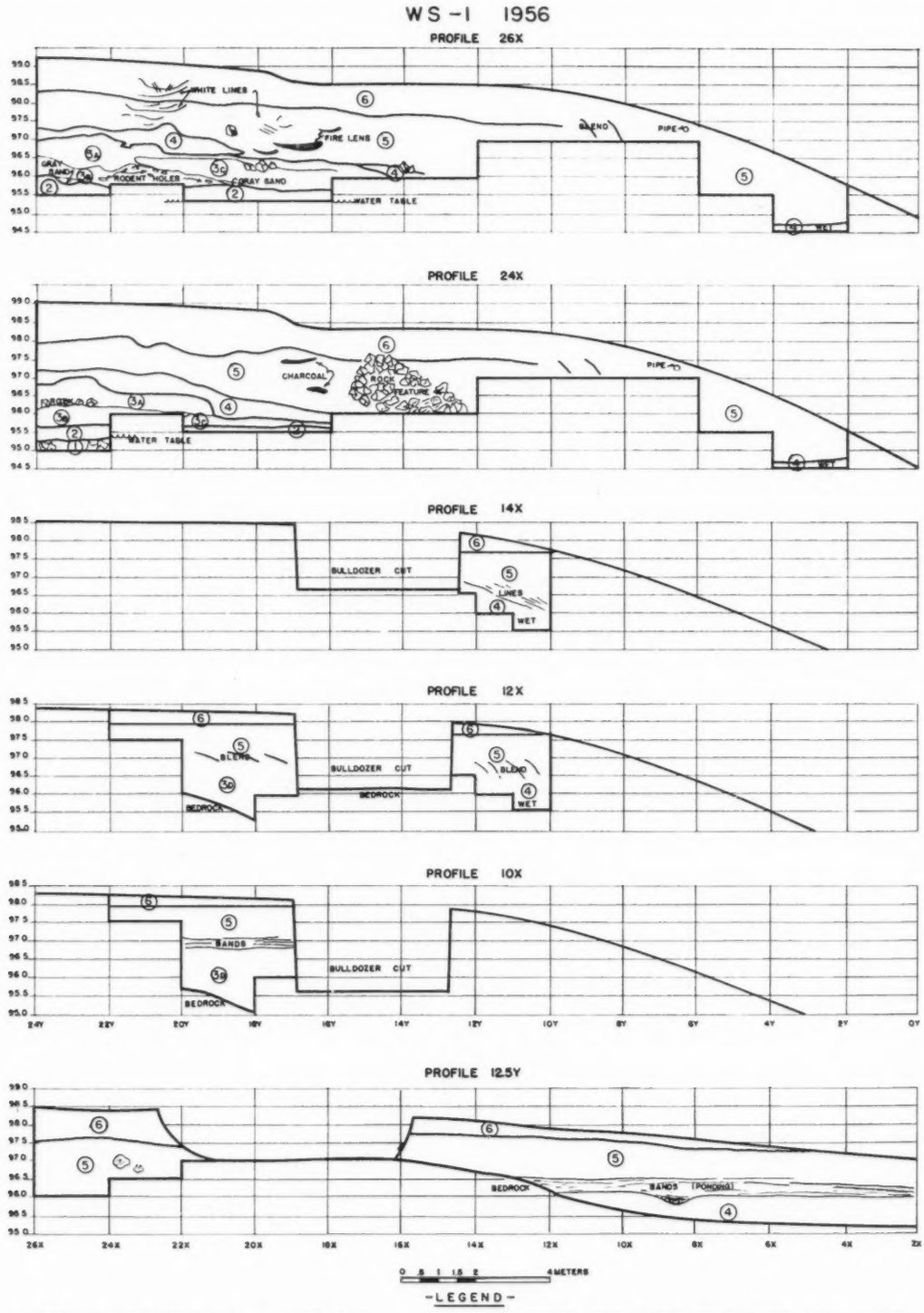


FIG. 17. Profiles—WS-1, 1956.

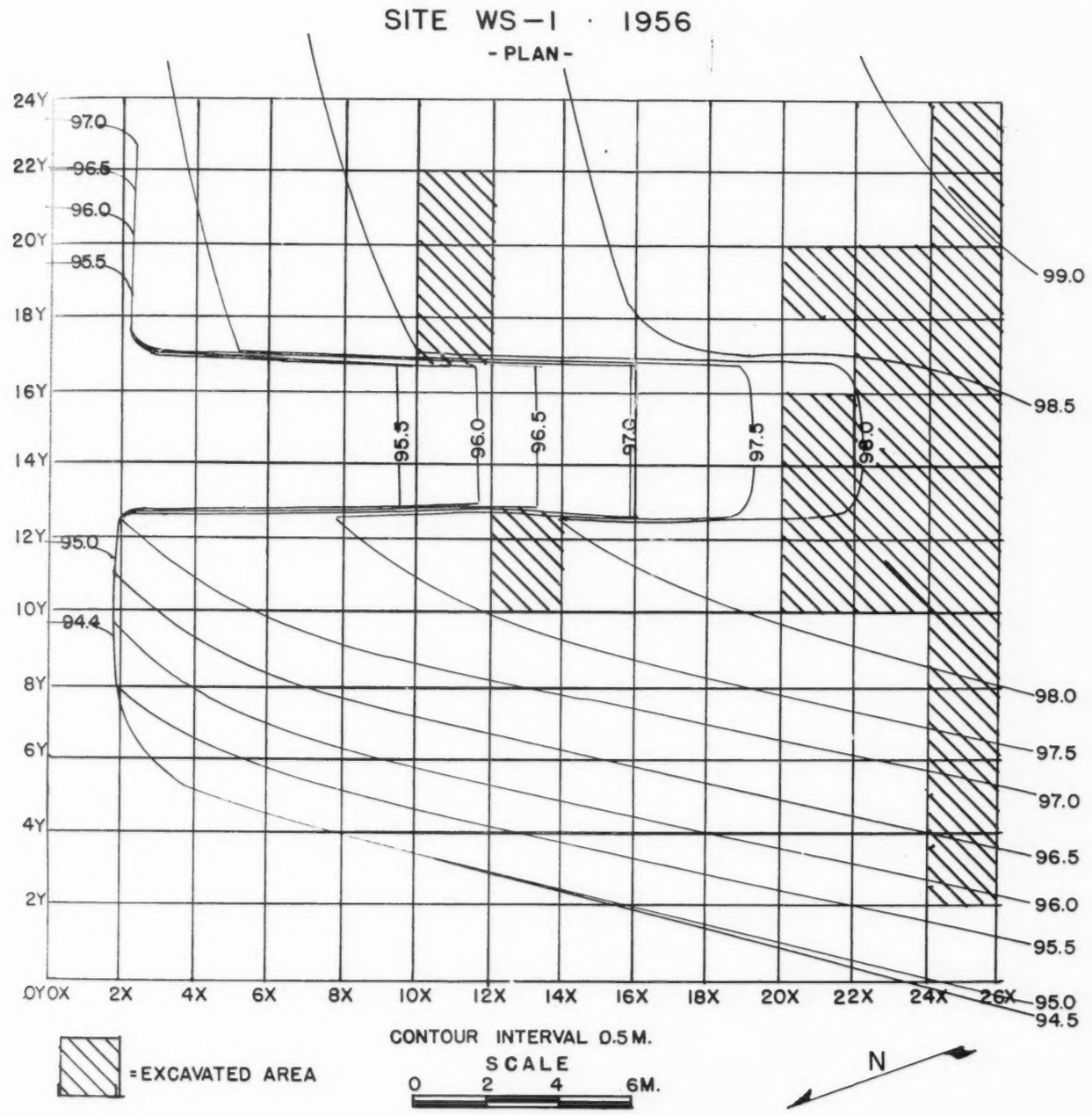


FIG. 18. Plan of excavation, WS-1, 1956.

ological evidence that the Oregon side of the river had a different history of human use than the north side it seems that the assumption is open to very serious question. The archaeological record as well as the simple facts of geography indicate that the Oregon shore was spatially directed toward the interior Oregon country and the Northern Great Basin whereas the Washington side had its closest affiliation with the Columbia Plateau area of central Washington. If the archaeologist could definitely associate a particular manifestation of culture with a particular group, in this case the Wasco, the problem could be easily resolved, but unfortunately this kind of relationship cannot be established. For present purposes we have to accept the assumption.

The Wasco occupied the south bank of the river from probably about Chenoweth Creek just west of The Dalles, to Celilo Falls some fifteen miles to the east. Their major settlement was supposed to be at

Fivemile Rapids but probably a few scattered villages existed through the strip along the river. Teit (1928) states that the Wasco claimed the land as far east as the John Day River but never occupied it. Spier states that the word Wasco is derived from the Chinook word, wá cq !o, meaning "small bowl" or "cup" (p. 168), the reference being to a cup-shaped rock into which a spring bubbled near the village. There were several springs close to the site WS-1 but these had either been closed off in the course of various construction projects or so modified otherwise that the exact location of the spring referred to is uncertain. There was a spring on top of the rim just above the west end of the site from which water was piped to the houses of the personnel of the Engineers before the building of The Dalles Dam. There was rock, probably part of the top of the rimrock, with a mortar worked into it close to this spring, but at that time the water certainly did not run into it and one cannot be certain that this was the spring referred to. When Mr. Cole represented the National Park Service at the removal of the bodies from Grave Island preparatory to raising the water in the reservoir of The Dalles Dam, Wasco Indians present to observe the removal told him that their "home had been right there" pointing to WS-1, the Big Eddy site. Construction work incident to developing navigation around the Fivemile Rapids had long since removed any remains of house pits from the area, if there had ever been any. It is strange that the excavations disclosed no clear-cut evidence of houses, although such a possibility was present at both WS-1 and WS-4 but the evidence is inconclusive.

We shall present briefly those aspects of Wishram life most likely to be reflected in the archaeological record using the assumption that sufficient similarity exists between the Wishram and the Wasco to use the former as the referent for the latter. Those aspects of the culture most likely to be reflected archaeologically are technology, subsistence patterns, settlement patterns, seasonal activities especially related to subsistence, and certain ceremonial patterns which may be represented either directly or indirectly, such as First Salmon or First Fruit ceremonies.

TECHNOLOGY

Projectile points. These parts of weapons which occur with such frequency in archaeological sites and in such an amazing variety of forms seem not to have been of much significance ethnographically. Spier writes, "These (bows and arrows) were used for small game as late as 1870 but only meagre descriptions are now available. McGuff observed that ordinarily bows had so little range that they were of no great value in still hunting . . . yet that strong men wielded bows of greater range" (p. 199), suggesting the possibility that both the self bow and sinew-backed bow were in use. A series of projectile points sketched for Spier by McGuff were from three-quarters of an inch to two inches in length and, with the exception of one with "acute barbs," all had rounded shoulders and presumably a contracting stem ("tanged"). Another sketch suggested a multiple-barbed bone head but more likely a barbed-stone head set in a multiple-barbed bone foreshaft. This latter type was supposed to be limited to war and use by chiefs.

Knives are described only as being "both single and double edged," set in deerhorn handles, and "used for skinning, butchering and as weapons rather than wood-working." Adzes of the straight variety are said to have been used for wood-working and are also attributed to the Wasco on the basis of a reference to one in a tale. *Awls, needles,* and *slivers of flint* were used for sewing. (Flint as used by Spier and Sapir evidently refers to the varieties of siliceous stone used for flaking, mostly derived from the river gravels.) Awls were presumably made from bone but needles were usually made from some variety of hard wood. The needle is described as round and the flat one frequently used for sewing mats (Cressman, 1950) is not mentioned.

Stone pestles twelve to fourteen inches long were used with wooden mortars for pulverizing dry "fish, roots, berries" but *wooden pestles* were used for fresh berries. Stone mortars (bowls) were used for cooking. Spier and Sapir state that both the pestle and mortar were made from granite but this is probably in error as the most frequent material is basalt. Granite did occur in the gravels having been brought down from far upstream but usually the specimens were not sufficiently large to serve the purpose of a large bowl except in occasional circumstances. The material was not in sufficient quantity of large enough size to meet the requirement that it should be *the* material for these instruments.

Sinkers, stones of about three pounds in weight, were of two kinds and used on the seines. One type was generally flat and pierced for the rope while the other generally tended to be oval and was girdled for fastening.

SUBSISTENCE

Fishing, the main economic activity of the Wishram, was generally of two kinds, that using a dip-net and sometimes the seine but spearing was also practiced. The dip-net consisted of a net fastened to a wooden ring which in turn was fastened to a long pole about two inches in diameter. Spier states that a rope was attached to the handle at its juncture with the ring and this was in turn fastened to a rock to steady the net in the swift current. The writer never saw any of the many Indians fishing with dip-nets using such a rope. Many of the fishermen had lines around their waists with the other end fastened to a rock or some anchor to enable them to be pulled out if they fell off their fishing platforms.

Fishing spots were hereditary and ownership might be held in common among six to ten men. Platforms were built out over the edge of the water or, if the cliff afforded a satisfactory place to stand, the owner would improve the footing by using a plank or some boards with one end anchored in a cleft in the rock and fish from that. The fisherman, standing on his platform, let his net drift slowly down with the current approximately to the limit of the arc permitted by the length of the pole. The salmon, swimming against the current, came into contact with the net and when the fisherman felt the contact he hauled out the net. This fishing was done by "feel" and not by sight because visibility in the turbulent current was nil. Little, if any, of this kind of fishing gear, other than the sinkers and net gauges, would be expected to be preserved in open archaeological sites. Salmon are reported to have been speared in the fall. Spearing and netting stations were separate and neither place could be used for the other activity. Fishing in the Fivemile Rapids area became unproductive with the falling level of the river, for the stations, particularly on the north shore, were seldom in a favorable position alongside the narrow main channel. At Celilo Falls, however, where the channel was directed over the falls on the south side of the river the ingenuity of the Indians in constructing platforms made it possible to take salmon here as long as there were any moving upstream.

Other fish taken were the sturgeon, lamprey, and smelt, the latter two of which were taken with small nets with smaller mesh than used in the salmon nets. Sturgeon are bottom feeders and would normally be taken with a hook and line, a method of fishing that was very little used at Fivemile Rapids.

Spier and Sapir are quoted here to show the fish resources, which together with the special character of the river, "a maze of narrow channels, whirlpools, and eddies between the precipitous shores and the rocks jutting up in the stream," gave such importance to the Fivemile Rapids area.

> The Columbia, the largest river of the Pacific Coast, contains fish at all times of the year and at certain seasons the fish ascending the stream run in prodigious numbers.
>
> The Columbia is somewhat south of the best salmon area, yet five species of salmon (*Oncorhynchus*) ascend the river, and with them the steelhead trout (*Salmo*) confused with the salmons by Indian and white fishermen alike. Cob (Pacific Salmon Fisheries, 8–11) states that the largest of the salmon, variously called chinook, spring, tyee, or king salmon, come to the Columbia in "three runs, the first entering during January, February, and March, and spawning mainly in the Clackamas and neighboring streams. The second, which is the best run, enters during May, June, and part of July, spawning mainly in the headwaters. The third run occurs during late July, August, September, and part of October, and spawns in the tributaries of the lower Columbia." The blueback (red or sockeye) enters with the spring run of chinooks. The silver (coho or white) species "usually appears in July, and runs as late as November." Only few of the humpback or pink salmon occur as far south as the Columbia. The run of dog or chum salmon is about the same as that of silver salmon; "from about the middle of August till late in November." The principal center of abundance of steelhead trout on the Pacific coast is the Columbia River, where it is found during the greater part of the year. The size of these species varies considerably: in this stream their average weights are respectively about 22, 5, 6, 4, 8, 8–15 pounds. So far as the salmon and steelheads are concerned, the most plentiful supply on the middle Columbia would seem to be in summer (May to October) especially its earlier half. Midwinter and again April seem to be periods of ebb. Lewis and Clark observed April 19, 1806, that the first salmon arrived in the vicinity of the Dalles (Hosmer, II 261, *cf.* 257) (p. 174).

The importance of fish in the subsistence pattern and economy of the Indians of this section of the river is shown by the description given by Lewis and Clark of the dried salmon piled on the rocks at Celilo Falls:

> Near our camp are five large huts of Indians engaged in drying fish and preparing it for the market. The manner of doing this, is by first opening the fish and exposing it to the sun on their scaffolds. When it is sufficiently dried it is pounded fine between two stones till it is pulverized, and is then placed in a basket about two feet long and one in diameter, neatly made of grass and rushes, and lined with the skin of a salmon stretched and dried for the purpose. Here they are pressed down as hard as possible, and the top covered with skins of fish which are secured by cords through the holes of the basket. These baskets are then placed in some dry situation, the corded part upwards, seven being usually placed as close as they can be put together and five on top of them. The whole is then wrapped up in mats, and made fast by cords over which mats are again thrown. Twelve of these baskets, each of which contains from ninety to a hundred pounds, form a stack, which is now left exposed till it is sent to market; the fish thus preserved are kept sound and sweet for several years, and great quantities of it, they inform us, are sent to the Indians who live below the falls, whence it finds its way to the whites who visit the mouth of the Columbia. We observe both near the lodges and on the rocks in the river, great numbers of stacks of these pounded fish (Allen, **2**: 212).

The entry in their journal for October 24, 1805, describing their arrival at Fivemile Rapids and the reconnaissance of the rapids, or "Narrows," records the same methods of drying and preparing fish and reads, "The stock of fish dried and pounded were so abundant that we counted one hundred and seven of them making more than ten thousand pounds of that provision" (Allen, **2**: 219). In the same entry describing the inside of one of the houses at the village near the Wakemap mound it states, "One half of the inside is used as a place of deposit for their dried fish, of which there are large quantities stored away, and with a few baskets of berries form the only family provisions" (Allen, **2**: 220).

To the staple fish diet were added berries, roots, and a small amount of game. Lewis and Clark constantly remark on the fact that the Indian hunting parties returned in this area, as well as further up the river,

with little or no game. Hunting was engaged in usually in the fall with the parties under a leader moving to the lower slopes of the mountains. The Wishram used the Mount Adams area for hunting and probably the Wasco hunted toward the slopes of Mount Hood. Hunting with their small bows was inefficient so that pit hunting, drives by which the game, elk or deer, were driven to a hunter in hiding, and pursuing the game in deep snow when it could be overtaken and clubbed, were preferred methods. Bears were sometimes killed when parties were gathering huckleberries but they were not liked as food, though their fur was highly prized (Spier and Sapir, 1931: 181). Berries and roots were pulverized in wooden mortars while food was boiled by the hot stone method in stone mortars, although it is possible that the wooden mortars were also used. Pit roasting was the method mostly in use, for cooking and boiling took second place.

Mountain sheep are not reported as being eaten but the horns of dead animals were picked up on the mountain ranges and used to make the elegant spoons and bowls found among the Wishram and the Wasco. Lewis and Clark report a hunting party further down river returning after having killed mountain sheep.

HOUSES AND SETTLEMENT PATTERNS

Lewis and Clark report that the first timbered houses were encountered at the head of Fivemile Rapids on the Washington shore.

> The houses, which are the first wooden buildings we have seen since leaving the Illinois country, are nearly equal in size, and exhibit a very singular appearance. A large hole, twenty feet wide and thirty in length, is dug to the depth of six feet. The sides are then lined with split pieces of timber, rising just above the surface of the ground, which are smoothed to the same width by burning, or shaved with small iron axes. These timbers are secured in their erect position by a pole, stretched along the side of the building near the eaves, and supported on a strong post fixed at each corner. The timbers at the gable ends rise gradually higher, the middle pieces being the broadest. At the top of these is a sort of semi-circle made to receive a ridgepole, the whole length of the house, propped by an additional post in the middle, and forming the top of the roof. From this ridgepole to the eaves of the house, are placed a number of small poles or rafters, secured at each end by fibres of the cedar. On these poles, which are connected by small transverse bars of wood, is laid a covering of the white cedar, or arbor vitae, kept on by strands of the cedar fibres: but a small distance along the whole length of the ridge-pole is left uncovered for the purpose of light, and permitting the smoke to pass through. The roof thus formed has a descent about equal to that common among us, and near the eaves is perforated with a number of small holes, made most probably to discharge their arrows in case of an attack. The only entrance is by a small door at the gable end, cut out of the middle piece of timber, twenty-nine and a half inches high, and fourteen inches broad, and reaching only eighteen inches above the earth. Before this hole is hung a mat, and on pushing it aside and crawling through, the descent is by a small wooden ladder, made in the form of those used amongst us. (The half at the end opposite the door is for storage of food while the other half provides the living quarters.) On each side (of the latter) are arranged near the walls, small beds of mats placed on little scaffolds or bedsteads, raised from eighteen inches to three feet from the ground, and in the middle of the vacant space is the fire, or sometimes two or three fires, when, as is indeed usually the case, the house contains three families (Allen, 2: 219–220).

Mat houses built above ground, both rectangular and round, were also in use.

Information derived both from Lewis and Clark and Spier and Sapir fails to give any basis for the formulation of any definite settlement pattern other than that the house clusters were along the river. We cannot tell from the former source whether all the villages they (Lewis and Clark) observed were occupied simultaneously, whether some were temporary fishing villages, or whether some were the remains of permanently abandoned living places. Spier and Sapir (1931: 164–173) indicate that the largest Wishram village was the one at the head of Fivemile Rapids and may have contained four hundred inhabitants. This was a permanent village but they speak of others as being probably winter settlements, others as being temporary, i.e., while the fish run lasted, and that the bank on the shore could be effectively used for fishing. Lewis and Clark repeatedly emphasize the scarcity of firewood in their trip down the Columbia and at two of the village sites listed by Spier and Sapir note that the location was a good one at which to get driftwood (and this means for firewood).

Hodge (1912: 919) reports for the Wasco: "Two types of houses were in use—the partly underground winter house, roofed with cedar bark and having board platforms about the walls for beds, and the summer house with frame of fir poles and covering of tules or cedar bark; the latter type might have several fireplaces, accommodating three or four families." It is generally assumed that the winter house was like that of the Wishram (rectangular) but there is nothing in the above description to suggest this similarity. Construction in the area ascribed to the Wasco had obliterated all surface evidence of any houses which might have been there, as we have mentioned previously. Examination by the writer of various sites inside the archaeological area but outside the main area of construction has never revealed any signs of housepits. Our archaeological work failed to produce any conclusive evidence of pits, such as might have been the remains of the kind of underground house described by Lewis and Clark for the Wishram. It is possible that the winter villages were some distance in from the river to avoid the winds so characteristic of the Oregon side of the Columbia River at The Dalles. This suggestion is purely conjectural, but Lewis and Clark, who camped the night of October 25, 1805, at the mouth of Mill Creek in the present town of The Dalles failed to mention any houses of any kind in the Wasco area.

While they were visited by Indians at their camp, it seems clear from the account that the visitors crossed from the Washington shore or stopped on their return from hunting on the Oregon side of the river. Since Clark reconnoitered the "Long Narrows" on October 24 preparatory to the passage the next day it is reasonable to conclude that if there had been any houses visible on the Oregon shore he would have reported them according to his practice for the rest of the river. The absence of any record of a village is the more difficult to understand since the main Wasco village was supposed to be located immediately across from where he must have examined the channel; this was our WS-1 site. Murdock (in Ray and others, 1938: 402) writes about the Tenino, neighbors of the Wasco to the east and south: "The Tenino, to their recollection, were never thus driven from the south bank of the Columbia; *the apparent lack of occupation was due to the fact that all their permanent villages were located several miles or more to the south, away from the river.*" (Emphasis ours.) Could the Wasco have followed the same settlement pattern? We do not know.

Finally, the situation concerning house types in the Wishram-Wasco area is not at all clear. Spier and Sapir (1931: 202) reported both the rectangular and the customary round underground house of the plateau for the permanent types. This information is derived from their two informants, one of whom described the circular type while the other reported the rectangular. Lewis and Clark on their westward journey described only the rectangular and the mat house above ground. On their eastward route, they described on April 14, 1806, seeing and entering circular underground houses among the White Salmon Indians west of The Dalles (Allen, 3: 56):

> The houses are detached from each other, so as to occupy an extent of several miles, though only twenty in number. Those which are inhabited are on the surface of the earth, and built in the same shape as those near the rapids; but there were others at present evacuated, which are completely under-ground. They are sunk about eight feet deep, and covered with strong timbers, and several feet of earth in a conical form. On descending by means of a ladder through a hole at the top, which answers the double purpose of a door and a chimney, we found that the house consisted of a single room, nearly circular and about sixteen feet in diameter.

On April 19, 1806, arriving at the Wishram village at the head of the Long Narrows, the point at which he had described the rectangular wooden house earlier, he reports that they have moved their village a few hundred yards down the river "and have exchanged the cellars in which we then found them, for more pleasant dwellings on the surface of the ground" (p. 63). It is this reference to "cellars" in addition to the informants' report together with the circular houses among the White Salmon, that apparently leads Spier and Sapir to say that both the circular and rectangular types of houses were in use at the Long Narrows. Lewis and Clark were very impressed by the appearance of this first timbered house among the Wishram and may have seen others but since the circular ones were also in use further up the river did not find it necessary to report them. It would be entirely reasonable to expect the circular house with its subterranean pit to be the more common one since the Indians at the head of the Long Narrows were oriented more toward the plateau as far as contacts went than to the west. Again in a contact area such as this it would be expected that both types of houses would be found. Obviously, the evidence is conflicting.

SOCIAL ORGANIZATION

The social organization of the Wishram was again a mixture of plateau and down river patterns. There was a class system of chiefs, middle class, and poor, together with slaves who were either prisoners of war or secured by purchase or trade. The class lines do not seem to have been rigidly drawn nor was wealth the only basis for chieftainship. There were chiefs who were not rich and there were rich men who were not chiefs. The highest class was apparently that of the hereditary chiefs and their families. Spier and Sapir suggest that the middle class was presumably made up of those who had some distant affiliation with chiefs. The lowest class consisted of the poor and there was probably little to choose between their lot and that of the slaves except that the poor were secure in their persons.

Marriage of the chiefs took place with families of equal rank of other tribes while for the other classes it could be either exogamous or endogamous. Polygyny was practiced. Residence for the newly married was patrilocal. Exchange of property at the marriage of those of the highest class was formalized very much in the manner of Kwakiutl practice. Apparently each group might have a number of chiefs at the same time. Chiefs had sufficient prestige and power so that their word was implicitly obeyed.

RELIGION

Religion was essentially the quest for power through acquisition of a guardian spirit by some action which required both endurance and bravery. The young person who desired a guardian spirit to give him more than the ordinary skill and power in some phase of his life activities began to train during late puberty by going on power quests. He was sent out at night to some distant and lonely spot where he piled rocks into cairns, brought back some object to prove he had been to the place to which he had been sent, swam in the river or mountain stream, etc. Eventually, the quest was rewarded by some visionary experience. As a general rule the identity of the guardian spirit was kept a secret until just before the death of the owner when he revealed it by exposing some object which would

identify the spirit, for example, a backbone of a wolf to identify the wolf as his spirit. Sapir (1909: 251) gives a Wasco tale, "The Big-Footed Man," in which the hero on the insistence of his mother secures, in order, power of "The Five Thunders and Lightnings," "Five bands of Grizzly Bears," "Five bands of Elk," "Five Whirlpools," "Five long-legged Water-Spiders," and finally of "Five bands of Yellow Flies running on the water" to have the strength and skill for his task, to kill his father, a great chief living near the mouth of the Columbia.

Shamans received their power in the same general way but the experience was more intensified for them. A shaman might have several spirits, a condition which would make him the more powerful.

TRADE

The Wishram and the Wasco, living in their strategic location at the Long Narrows, had developed a trading economy in which they were the focus of contacts of Indians coming to trade for many miles from the interior and the coast. In this situation it is no wonder that it is difficult to isolate configurations of culture which might be used for historical reconstruction. Spier and Sapir (1931: 224–228) have brought together the material from various sources describing this trading economy and their account follows:

> If there was any one outstanding aspect of Wishram life it was trading. They were famous as the possessors of a trade market among tribes for a vast distance around and were inordinately proud of their reputation. In fact, they commonly render the name of their principal settlement, Nixlu'idix (now Spedis, Washington), as "trading place," although the word is perhaps not capable of being etymologized. The vicinity of The Dalles was probably the most considerable trading establishment of the whole northwest, marking the meeting place of the interior and coastal groups in the bottle-neck of the gorge of the Columbia as it cuts through the Cascade range.
>
> The role of the Wishram as traders was entirely that of stay-at-homes; there is no evidence that they ever went abroad to trade. They were wholly middlemen. It must not be assumed that the trade at The Dalles was wholly in their hands; the Wasco on the opposite, south, side of the river, and the adjacent bands of Sahaptins, shared in it equally. In earlier days, perhaps prior to 1750, the Salish groups who occupied the banks of the Columbia immediately above them to the east participated in this middleman's role.
>
> Teit furnishes an excellent summary of trading at the Dalles.
>
> "The Columbia and Wenatchi (of east central Washington) were the principal traders of the Salish people in the west, and large numbers of them went annually to The Dalles, where they traded with the Wishram, Wasco, and other tribes. It seems that long after the tribe was pushed out of the country near The Dalles and farther north, their trading-parties still claimed and maintained right of way through every part of the country to The Dalles. It is said that large, well-armed, and well-equipped parties of Wenatchi and Moses-Columbia annually passed through the Yakima country to The Dalles; and some other of their parties, in conjunction with Spokane, went south on the opposite side of the river, through the Wallawalla and Cayuse countries. The common route, however, was on the west side of the river, through the Yakima country.
>
> "Trading at The Dalles was in skins, fur, fish, oil, roots, pemmican, feathers, robes, clothing, shells, slaves, and horses. On the whole, products of the lower Columbia, the Coast, and the southern or Oregon country, were exchanged for products of the interior east and north.
>
> "Many of the products obtained by the Columbia Salish at The Dalles and west of the Cascades were carried across country and sold to the Sanpoil, Okanagon, and others, at a profit. . . . Products from as far south as the Modoc, Rogue River, and Shasta reached The Dalles, also from a considerable distance north and south on the coast, and from the Plains.
>
> "Revais said that the greatest intertribal trading-place was at The Dalles. The people there lived entirely by fishing and trading. They bought almost anything brought to them, and resold it again. Grande Ronde, in eastern Oregon, was an important trading-place. Other places were the mouth of the Cowlitz, near Scappoose or about opposite the mouth of the Lewis, near Oregon City, the western Grande Ronde, the middle Nisqually, the upper Puyallup, near the mouth of the Okanagon, near Colville, and near the mouth of the Snake; but there were other minor trading-places in the territories of most tribes. Considerable trade from the west and southwest of Oregon and from the Klamath (River?) passed through the Kalapuya to Oregon City and thence to The Dalles. . . . Things traded, say, at the Grande Ronde and Okanagon were retraded at The Dalles. Products from the coast of Washington and Oregon, Puget Sound, the plateaus of the interior to the north and east, the Plains, the interior of Oregon and northern California, reached The Dalles.
>
> "Slaves were very numerous on the lower Columbia and at The Dalles long ago. They were boys and girls and some adults. All the Oregon tribes dealt more or less in slaves and resold them. . . .
>
> "Shells, beads, Hudson Bay blankets, robes, cloths, horses, and fish were probably the principal things traded, also slaves, canoes, dressed skins, furs, and the like. Furs sold by The Dalles people to the Hudson Bay Company were all procured from other tribes. In later days they had few for sale, as the trapping-tribes traded directly with various posts. Some people of the following tribes came to The Dalles in the trading season: Columbia, Spokane, Yakima, Klickitat, Tyighpam, Wallawalla, Umatilla, Cayuse, and sometimes Palous, Nez Perce, Klamath, Molala, and Kalapuya. On the whole, the exchange of products at the Dalles was south and southwest versus north and northeast. The Wishram and Dalles people generally, and the Kalapuya, were always more or less hostile to the white traders. They resented the direct trade with neighboring tribes considering that they should by rights act as middlemen." (Teit, *The Middle Columbia Salish*, 121–2.)

In addition to the tribes who visited The Dalles for trade cited by Teit, our informant listed Toppenish, Wenatchi, and Nespelem. People came from everywhere to the east in the spring, from as far as the Spokane. Elsewhere food was scarce by spring but the Wishram had plenty, especially dried salmon. They brought a variety of wild products, such as wild potatoes, to exchange for salmon. On the other hand, the lower Columbia people came only rarely to The Dalles and then only members of the higher classes, such as chiefs and important shamans. They came with canoes which they traded for buffalo robes.

The trade on the river was described by Lewis and Clark in 1806 in the following terms. "Of that trade, however, the great emporium is the falls (The Dalles to Celilo Falls), where all the neighbouring nations assemble. The inhabitants of the Columbia plains (i.e., between the falls

and the Snake River), after having passed the winter near the mountains, come down as soon as the snow has left the valleys, and are occupied in collecting and drying roots till about the month of May. They then crowd to the river, and fixing themselves on its north side, to avoid the incursions of the Snake Indians, continue fishing till about the first of September, when the salmon are no longer fit for use. They then bury their fish and return to the plains, where they remain gathering quamash till the snow obliges them to desist. They come back to the Columbia, and taking their store of fish retire to the foot of the mountains, and along the creeks which supply timber for houses, and pass the winter in hunting deer or elk, which, with the aid of their fish, enables them to subsist till in the spring they resume the circle of their employments. During their residence on the river, from May to September, or rather before they begin the regular fishery, they go down to the falls, carrying with them skins, mats, silk-grass, rushes and chappelell bread. They are here overtaken by the Chopunnish (Nez Perce) and other tribes of the Rocky mountains, who descend the Kooskooskee and Lewis's River for the purpose of selling bear-grass, horses, quamash, and a few skins which they have obtained by hunting, or in exchange for horses with the Tushepaws.

"At the falls they find the Chilluckittequaws [White Salmon?], Eneeshurs [local Sahaptins?], Echeloots [Wishram], and Skilloots [Wishram?], which last serve as intermediate traders or carriers between the inhabitants above and below the falls. These tribes prepare pounded fish for the market, and the nations below bring wappatoo roots, the fish of the seacoast, berries, and a variety of trinkets and small articles which they have procured from the whites.

"The trade then begins. The Chopunnish and Indians of the Rocky mountains exchange the articles which they have brought for wappatoo, pounded fish, and beads. The Indians of the plains, being their own fishermen, take only wappatoo, horses, beads, and other articles procured from Europeans. The Indians, however, from Lewis's river to the falls consume as food or fuel all the fish which they take; so that the whole stock for exportation is prepared by the nations between the Towahnahiooks (John Day River?) and the falls, and amounts, as nearly as we could estimate, to about thirty thousand weight, chiefly salmon, above the quantity which they use themselves or barter with the more eastern Indians. This is now carried down the river by the Indians at the falls, and is consumed among the nations at the mouth of the Columbia, who in return give the fish of the seacoast and the articles which they obtain from the whites. The neighbouring people (i.e. at the mouth) catch large quantities of salmon and dry them, but they do not understand or practice the art of drying and pounding it in the manner used at the falls, and being very fond of it, are forced to purchase it at high prices. This article, indeed, and the wappatoo form the principal subjects of trade with the people of our immediate vicinity. The traffic is wholly carried on by water; there are even no roads or paths through the country, except across the portages which connect the creeks.

"Many Indians from the villages above passed us (Lewis and Clark, at the Cascades) in the course of the day, on their return from trading with natives of the (lower) valley, and among others we recognized an Eloot (Echeloot, Wishram) who with ten or twelve of his nation were on their way home to the long narrows of the Columbia. These people do not, as we are compelled to do, drag their canoes up the rapids, but leave them at the head, as they descended, and carrying their goods across the portage, hire or borrow others from the people below. When the trade is over they return to the foot of the rapids, where they leave these boats and resume their own at the head of the portage. The labour of carrying the goods across is equally shared by the men and women, and we were struck by the contrast between the decent conduct of all the natives from above and the profligacy and ill manners of the Wahclellahs" (Hosmer, II, 149–151, 249).

Ross writes of the trade in the Wishram-Deschutes country five years later: "The main camp of the Indians is situated at the head of the narrows, and may contain, during the salmon season 3,000 souls, or more; but the constant inhabitants of the place do not exceed 100 persons, and are called Wy-am-pams (Deschutes); the rest are all foreigners, from different tribes throughout the country, who resort hither, not for the purpose of catching salmon, but chiefly for gambling and speculation; for trade and traffic, not in fish, but in other articles; for the Indians of the plains seldom eat fish, and those of the sea-coast sell, but never buy fish. Fish is their own staple commodity. The articles of traffic brought to this place by the Indians of the interior are generally horses, buffalo-robes, and native tobacco, which they exchange with the natives of the sea-coast and other tribes, for the higua (dentalium) beads and other trinkets. But the natives of the coast seldom come up thus far. Now all these articles generally change hands through gambling, which alone draws so many vagabonds together at this place; because they are always sure to live well here, whereas no other place on the Columbia could support so many people together. The long narrows, therefore, is the great emporium or mart of the Columbia, and the general theatre of gambling and roguery.

"We saw great quantities of fish everywhere; but what were they among so many: we could scarcely get a score of salmon to buy. For every fisherman there are fifty idlers, and all the fish caught are generally devoured on the spot; so that the natives of the place can seldom lay up their winter stock until the gambling season is over, and their troublesome visitors gone. All the gamblers, horse-stealers, and other outcasts throughout the country, for hundreds of miles round, make this place their great rendezvous during summer" (Ross, *Adventures of the First Settlers*, 129–130.)

The trade was by no means always direct with the Wishram. The Nez Perce sometimes brought buffalo robes to trade with the Klickitat for their baskets. They in turn took them to the Wishram to exchange for cured fish (salmon, sturgeon, and eels). Nez Perce parfleches among the Yakima, Klickitat, and Wishram—and practically all of these were of Nez Perce manufacture—attest to another article of trade. The Wenatchi journeyed westward across the Cascades to trade with the tribes of Puget Sound and southward. Doubtless articles from the coast, such as shells, found their way in this fashion to the Wishram.

The Wishram also traded with the Wasco for dried elk and deer meat. The Wasco had direct trading relations with the Umatilla, more extensive than those of Wishram with the latter, by which they acquired buffalo robes. The direct contact of Umatilla with Wasco was presumably due to the former coming on horseback, hence keeping to the south side of the Columbia. Occasionally the Umatilla brought a horse or two for the Wasco, which further changed hands until it came into possession of the Klickitat, who became horsebreeders. Before 1825–30 these Indians had no horses or few which were then confined to the Nez Perce and Umatilla. The coming of the horse doubtless gave great impetus to trading.

The Klamath may not have had much direct contact with the Wishram. Klamath informants were indefinite as to the exact locality they visited on the Columbia; it

was vaguely The Dalles. It is most probable that they traded rather with Wasco, since the objectives of their trading expeditions were Warm Springs as well as The Dalles. Slaves, Pit River bows and beads, and lily seed were taken there to exchange for horses, blankets, buffalo skins, parfleches, beads (probably dentalium shells), dried salmon, and lamprey eels. Occasionally they stayed the winter on the Columbia, sometimes for a number of years.

There is at least one observation on the comparative wealth of the tribes in the general vicinity of The Dalles. Our informant stated that the Toppenish and Wenatchi were very poor, even among "the supposed first class." They drifted about, managing a trade now and then, but had no status until absorbed by the Klickitat. These statements must be interpreted as relative to the substantial wealth implied for the Wishram.

Special friendships with foreign Indians were sometimes the result of these trade contracts. "When one has a friend in another country (i.e. among another tribe), he comes to see you, or you go to see him. Both are glad to meet each other; one gives the other a horse or something valuable, the other gives something in return. Such are each other's ie'lpet, trading-friend." (Sapir, *Wishram Texts*, 104.)

Sapir (1907: 541) gives further evidence of the lack of sharp cultural definition in the area:

> The most puzzling linguistic phenomenon found at Wishram, because it is at complete variance with what we have in the lower dialects, is the use of loosely tagged on postpositions, in some cases optionally prepositions. . . . It is of considerable theoretic importance, therefore, to note that the neighboring Sahaptin dialects, quite similarly to the Klamath, make an extended use of such case-suffixes. We would have then here a good example of the *grammatic*, not merely lexical, influence that dialects of one linguistic stock may exert on geographically contiguous dialects of a fundamentally distinct stock.

Sapir's later proposed major classification of North American Indian languages sets up a Penutian Group in which the Sahaptin and Chinook occur as families. This classification would make necessary a reformulation of the relationship expressed in 1907 and raises questions that, while they cannot at present be answered, are nonetheless of considerable importance for historic reconstruction.

Sapir in the same article (pp. 542–544) calls attention to the confusion in the content of the mythology of the Wishram, pointing out the mixture of plateau and coastal elements. Coyote, the Transformer of the Interior Plateau, vies with Salmon and Eagle. Yet, while Coyote is the main transformer, Sapir believes that the Salmon is the real local hero of the Wishram. Finally he writes (p. 544):

> On the whole, the chief interest of Wishram mythology seems to lie in its transitional character between the mythologies of the coast and the plateau. Although it shares, as we have seen, a local and specifically Chinookan salmon myth with the Lower Chinook, many of the myth motives are not duplicated farther down the river, but are found in other regions, such as the plateaus. Here again we observe that linguistic and cultural, more specifically mythologic, distribution areas are by no means necessarily congruent.

Since our study is one aspect of long-range culture history we shall return in a later chapter to some of the implications of the confusion of cultural elements in this area. In concluding this section on ethnohistory we shall list those significant elements in the developing contact situation between the Indians and whites together with a short description of the construction of transportation facilities along the river which so effectively damaged the archaeological sites. Furthermore, it is the nature of the Columbia River at Fivemile Rapids (The Long Narrows) that it effectively directed the cultural developments of the white man as it had earlier that of the Indian. The following statements with the exception of the last are extracted from "The Character of Wasco County" published by the Wasco County Planning Commission, January, 1954.

1805—The Lewis and Clark expedition reached the mouth of Mill Creek (in the present town of The Dalles) on Friday, October 25, 1805.

1820—A trading post was established at The Dalles by James Birnie but it did not operate very long.

1837—A Methodist mission was established at The Dalles by Reverends Daniel Lee and H. K. W. Perkins, who arrived here by canoe on March 22nd. The "square" of the mission buildings was near a large spring and a natural rock pulpit.

1843—The big wagon train came to The Dalles, bringing such men as Peter Burnett, the first Governor of California, M. M. McCarver, town builder and legislator, and Jesse and Lindsay Applegate, and Dr. Marcus Whitman also, who with his nephew Perrin Whitman, was returning from Boston. This was the first wagon train to reach The Dalles. Most of the people of this train went on by the Columbia River, Fort Vancouver and the Willamette River to the Willamette Valley. The wagons were abandoned at The Dalles. (Old Oregon Trail by Walter Meacham.)

1846—Joseph Lavendure, a French trapper, is recorded as the first settler making an effort to establish a claim and to begin farming in the county. He built a log house, fenced in a few acres and tried for permanence. He left for the California gold rush in 1848. His claim was later known as the Logan estate.

1848—May 16th, Father L. Rosseau established the Catholic Mission near the present Catholic cemetery across Mill Creek.

1849—A United States rifle regiment came overland to Fort Vancouver.

1850—May 13th, Col. Loring of Fort Vancouver sent Major Tucker with two companies of riflemen to establish a supply post at The Dalles. The first post was ten miles square but this area was reduced to five miles square in 1851.

1851—Steamboat service was established on the upper Columbia River. The "James P. Flint" with Captain Vanburgen in command made the first trip to The Dalles.

1854—Major Rains, then in command of Fort Dalles, again surveyed the fort site and also set out a triangular area east of the fort site for the site of the City of The Dalles. The City of The Dalles was established under the Townsite Act of Congress, July 17, 1854.

1860—December 20th, the Oregon Steamship and Navigation Company was legally organized and by 1862 was in control of the portage at the Cascades and at The Dalles around the narrows to the east. Soon steam railroads were built for these portages.

18[illegible]—Henry Villard bought the Oregon Steamship and Navigation Company's rights and formed the Oregon Railway and Navigation Company. Soon work began on the south bank of the Columbia on the railroad line from Portland to Walla Walla. This road was completed in 1881.

1896—Nov. 5th, the Cascade Canal and locks were opened to use even though more work was yet to be done to make them complete.

1915—The Dalles-Celilo Canal and locks completed.

1938—Bonneville Dam and locks completed.

1957—March 17th, closure of The Dalles Dam and raising the water to the 155 foot level inundating Sites WS-1, part of WS-4 and Wakemap. Dedication and opening of the navigation locks. The Long Narrows now submerged, along with the forbidding basalt exposures across which Lewis and Clark could not portage, under the new reservoir.

V. CLASSIFICATION OF ARTIFACTS

All our artifacts fall essentially into three categories according to the material from which manufactured, antler, bone, or stone, except for some trade pieces in the burial furniture from a grave near the end of the occupation of the site and one small fragment of basketry from a much earlier point in the occupation. The antler and bone, except for four minute, carved fragments which are referred to elsewhere since they are out of context in this group of "antler and bone" specimens, are limited to the Early Period of the site. An artifact series, new to North American archaeology both in kinds of objects and in methods of manufacture, posed problems of classification and nomenclature. The description of the materials from the mesolithic site of Star Carr (Clark, 1954) in England provided the guide in our work.

The writer, during the spring of 1958, had the good fortune to examine, under the guidance of Dr. J. G. D. Clark and Dr. Geoffrey Bushnell, the Star Carr materials in the Museum of Archaeology and Ethnology at Cambridge. Dr. Clark had been provided earlier with photographs of our materials. Using the photographs for comparison with the Star Carr materials, Dr. Clark stated that the methods of manufacture, "nibble cutting," splinter removal by burin strokes, etc., were the same at the two sites almost half a world apart and contemporaneous. Some of the classes of tools were even alike. However, our Columbia River site produced a range of artifacts different from those at Star Carr which also had its distinctive series.

We have assigned "names" to some of our antler and bone artifacts but these are only the best guesses with which we could come up. The method of manufacture, where it could be determined, and the form of the object in each case have provided the bases for our categories. It will be obvious at once to anyone examining the illustrations that our categories are not always entirely exclusive. This is to be accounted for by the nature of the material. We were extremely fortunate to find specimens of antler in all stages from the raw material to the finished product. Consequently, in handling this kind of material there is bound to be some overlap of the category limits and a specimen could go here or there. When dealing with the finished product, that is the end product of the manufacturing process, exclusive categories can be set up when the object is complete or reasonably so.

The work of MacNeish (1956) on the Firth River in the Arctic, at the same time we were working on the Columbia, produced cylinders and bevel faces similar to ours, except that the raw material was caribou antler. MacNeish did not have pieces showing the different stages of the manufacturing process. His materials are the closest in North America to those from the Columbia River site with which we are familiar.

ANTLER ARTIFACTS

(Figs. 37–40)

All artifacts in this category were made from antler obtained from elk (*Cervus*) or deer (*Odocoileus*). These will be referred to as deer or elk.

Tine Flakers. Antler tines with proximal ends broken and/or cut and broken; distal ends blunted, beveled. Size range: length 29.3–8.8 cm. Material: deer and elk antler (fig. 37*a*).

Worked Pieces. (fig. 37*b*). Stock: (*a*) Beam bases with portions of frontal and parietal bones. One left base detached from skull by smashing (?). Beam and brow tine taken off with ringing cut, some longitudinal cuts, "nibble cuts" made by burin. One right base detached from skull by cutting and smashing. Beam removed below burr by ringing cut on the pedicle. Material: elk skull and antler (fig. 37*b*, B, C).

(*b*) Beam bases with or without tines; one base shed (fig. 37*b*, G), others taken off by ringing cut between brow tine and burr by "nibble" technique; tines broken or cut off; two specimens are singly grooved. Material: deer and elk antler (fig. 37*b*, D).

(*c*) Beam fragments; removed from beam by ringing cut and/or breaking. Five pieces have grooves and/or grooves and splinter scars. These splinters are assumed to be the same as slabs, see (*a*) under "splinters" below, which have been described separately. The maximum number of splinters taken from one piece is four. Material: elk and deer antler (fig. 37*b*, A, F, I, J).

(*d*) Tines; both have groove and splinter scars at base. One has groove and splinter scars along its length; one has the distal end beveled and it is probably a reworked piece. Material: elk antler (fig. 37*b*, E, H, K).

Splinters (fig. 40*c*, D–J). (*a*) Half round slab cut by burin from beam by means of two parallel grooves, one end freed by cutting and breaking, other end broken off. Dimensions: 12.5 cm. long, 2.9 cm. wide. Material: elk antler.

(*b*) Flats; cut from beam by means of two parallel grooves in four cases. One case from a tine has a single groove and cut end. This technique seems confined to tines while beam splinters are removed with two grooves. Dimensions: length 9.4–2.1 cm., width 2.6 cm.–1.0 cm. Material: elk and deer antler.

(*c*) Flat with end cut to a point. One edge of point is a groove edge, the other has been cut over a groove edge. Dimensions: 9.6 cm. long, 1.8 cm. wide. Material: elk antler.

Worked Fragments. This category includes a group of miscellaneous fragments showing some evidence of working. Most are fragmentary and in bad shape. Material: antler.

Beveled Faces (fig. 38). (*a*) Antler from burr area. Burr worked into a bulb, one side beveled convexly, opposing side concave to convex. Tips present are rounded. One broken specimen was reworked to provide splinters. Dimensions: 20.5–12.2 cm. long. Material: elk antler (fig. 38*a*, A, C, E).

(*b*) Antler from beam. Butt squared, one side beveled convexly, opposing side concave. Tips present are rounded. Dimensions: 15.6–11.9 cm. Material: elk antler (fig. 38*a*, B, D, F).

(*c*) Antler from burr-brow tine area. Butt square, one side convex, opposing side concave to convex. All have brow-tine stump remaining. Tips present rounded (fig. 38*b*, A, C).

(*c'*) Antler tines (?). Butt square, one side beveled convexly, opposing side concave to convex. Tips present are rounded. Dimensions: 9.6–7.5 cm. long. Material: elk antler (fig. 38*b*, B, D, E).

While there is edge breakage on the butt ends of some of these specimens, in the opinion of the writer it is insufficient to warrant identifying them as splitting wedges. This opinion is based on examination and handling of numerous wedges and on them the shattering is much more pronounced. It is his opinion that they are skin softeners and polishers. (Clark, 1954; MacNeish, 1956.)

Cylinders. (*a*) Antler beam bases. One end ground down flat, the other rough rounded where the beam was cut around and broken off, some have chips off the flat end. Dimensions: 8.2–6.4 cm. long, 4.2–3.5 cm. wide. Material: deer antler (fig. 39*a*, A–F).[1]

(*b*) Antler beam bases, broken. One end roughly squared, other end roughly rounded. One specimen is a shed base. Dimensions: length 9.5–6.2 cm., width 3.2–3.0 cm. Material: deer antler (fig. 39*a*, G–H).

(*c*) Antler tine. One end cut and broken, other end cut and smoothed. Dimensions: 9.6 cm. long. Material: deer antler (fig. 39*a*, I).

[1] These artifacts, again, give some evidence of their use. The smooth ends which in some cases are chipped suggest that they were used as hammers. Some of the associated flaked stone pieces bear flake scars strongly suggesting the "cylinder flaking" technique. These objects we class as cylinder flakers.

Pyriforms. (*a*) Antler beam bases, pyriform in shape. Base is smooth and convex; apex was rounded after it had been detached by ringing and breaking. Some of these may be shed antler bases, though indications of this condition are hard to determine because of their subsequent use. Dimensions: height 9.5–7.0 cm. Material: elk antler (fig. 39*b*, A–B).

(*b*) Antler beam bases of an elongate pyriform shape. This shape is the result of their being reworked butt ends of (*a*) type bevel faces. Bases are smooth and convex. Tops are not smooth showing evidences of cutting and breaking. Both of these artifacts show remnants of a former flat surface, one has a groove on its side. Dimensions: height 11.6–11.0 cm. Material: elk antler (fig. 39*b*, C–D).[2]

Miscellaneous (fig. 40*a*, *b*, *c*, *d*). (*a*) U-shape. Beam crotch. Beam and tine ends removed by ringing cut, remaining surface smooth. A U-shaped notch was cut into the beam probably by the same means, burin cuts, used to remove beam splinters. This cut was later smoothed. The ends of the specimen are broken off. Dimensions: width across base 5.9 cm. Material: antler (fig. 40*c*, A).

(*b*) Knob End Piece. Antler, possibly made from a splinter. The piece is weathered and broken longitudinally. One end was worked to a round point with a notch cut below the point to produce a knob end. Dimensions: length 6.0 cm., width 1.5 cm. Material: antler (fig. 40*c*, C).

(*c*) Pointed Object. Antler splinter (?). Butt is broken, one end has been ground down to a point with a concavity on the cancellous side. The lack of a butt makes any identification doubtful, though the specimen may be a remnant of an antler awl. Dimensions: length 5.6 cm. Material: elk antler (fig. 40*c*, B).

BONE ARTIFACTS

(Fig. 40)

Palmate. Pelvis shaft of elk. Flattened, smooth on all non-cancellous surfaces. One edge is beveled and striated. Tip is double-beveled, dull pointed. Foramen on smooth side has cut marks around it which were later smoothed over. Dimensions: length 20 cm., width at widest point 10.8 cm. Not illustrated.

Ulna Awls. Ulnae. Split from radius, head ground down. Generally smooth all over. Dimensions: length 10.7+ to 7.9 cm. Material: deer ulnae.

Spatulates. Long bone fragments. Bone was crudely split, though some evidence of grooving before splitting is apparent. Specimens were roughly smooth and have rounded beveled ends. Dimensions: length 15.3 to 14.6 cm. Material: elk long bone, probably from femur and tibia (fig. 40*d*, D).

Pierced Metacarpal Ends. Ends were removed by ringing and breaking. All have a hole drilled from the

[2] These artifacts could easily be put in the general category of hammers and rubbers.

cut edge through the sagittal notch. One specimen has two additional holes started at the cut edge and confined to the cancellous area of the bone. Dimensions: length 4.9–3.2 cm. Material: deer metacarpals (fig. 40*d*, F, I, K).

Worked Mandible. Pieces extensively ground with body worked into a curving shaft terminating in a rough, tongue-like point. The opposite end is squared and is probably the relatively unmodified symphyseal area of the mandible. Dimensions: length 9.8 cm. Material: elk mandible (?).

Split Phalanx. Split and polished half of phalanx of either elk or deer; distal end severed by ringing cut, carefully shaped by cutting and abrading (fig. 40*d*, H).

Bird Bone (fig. 40*d*, B). (*a*) Tubes (?). These are bird long bones, one end produced by a ringing cut, the other end broken. Dimensions: 6.6–2.0 cm. long (fig. 40*d*, G).

(*b*) Cut Radius End. Pieces broken, shows remnants of a ringing cut. Material: identified by Miller as the radius of Condor (*Gymnogyps*) (fig. 40*d*, J).

(*c*) Atlatl Spurs (figs. 20*e*; 40*a*, *b*, D–E). There are two of these, one of which is broken. The complete spur, E, resembles an isosceles triangle with a very acute angle at the apex and having the projection which engaged the cup of the spear, formed by a continuation of one side, while the other was excised at right angles to the mid-line, and the section then removed to the base. The end which engaged the spear is rounded, bluntly pointed and shows use polish. The basal surface is flattened and the upper sloping surface from the base of the spur point has a very slightly flattened area which is roughened by fine incised lines running across the surface. This treatment of both surfaces must have been to assist binding the spur in a groove cut into the upper surface of the atlatl. The overall length is 4.0 cm.; from apex to shoulder is 3.1 cm.; maximum height is 0.9 cm. and thickness 0.45 cm. The polished use area of the point extends for only 0.45 cm., indicating a very shallow cup. From Level 22.

The other specimen, D, though broken, would probably have been a duplicate of the first. It is a little higher, 0.6 cm. in height, and the use polishing extends back 0.65 cm. from the point. The base has a narrow flattened surface. Specimen from Level 28.

Both specimens indicate the northern type of atlatl in which the spur is inserted in the atlatl rather than being carved as a part of the instrument.

(*d*) Harpoon or Harpoon Prong (?) (figs. 20*c*; 40*a*, *b*, C) is of curved bone, roughly triangular in cross section, 5.2 cm. long, 0.6 cm. in width, and 0.3 cm. thick at the convex edge. It has four well-defined barbs on the concave edge with two shallow notches near the end. It is suggested that the shallow notches are for attaching this point by a cord to a detachable foreshaft after the manner of the specimen illustrated by Drucker (1955a: 28, fig. 5, *e*).

(*e*) Composite Harpoon Prong fragment (figs. 20*a*; 40*a*, *b*, *f*). A very dense bone flattened on one surface, rounded on other; rounded surface is grooved 4 mm. from end and for a distance of 2.5 cm. further is roughened by incised lines running generally across the surface, both devices obviously to facilitate effective lashing. Length is 5.1 cm., maximum width 1.0 cm., and 0.8 cm. is the greatest thickness. The suggestion has been made that this might be a piece of composite fishhook. From Level 37, near bottom.

(*f*) Sinew Smoother (?) (figs. 20*b*; 40*a*, *b*, G). A section of a long bone 3.8 cm. long by 1.3 cm. wide and 0.5 cm. thick has fourteen transverse grooves cut into it. From Level 21.

(*g*) Rake or comblike specimen, use completely unknown (figs. 20*f*; 40*a*, *b*, A). It is uncertain whether this is antler or a section of elk pelvis. One surface is highly polished as is the central part on the reverse side surrounding the hole. The hole, 1.0 cm. in smallest diameter, seems to have been drilled first from the rear side for it runs at right angles to the plane of that surface, and then is completed from the opposite surface. The top is worked into a deep notch with diverging points. The bottom end terminates in four tines, three of which have old breaks; an outside one lost its tip evidently during excavation. Measurements are: maximum length 12.1 cm., maximum width at top 9.5 cm., minimum width at tines 4.5 cm., width at hole 5.5 cm., maximum thickness 2.3 cm. From Level 27.

(*h*) Notched elk incisor necklace (?) consisting of eight teeth (fig. 40*d*, B).

STONE ARTIFACTS

PROJECTILE POINTS

The wide range of forms of projectile points from the exuberant stone industry of the Columbia River in the area of The Dalles and further east makes all existing taxonomic systems inadequate to serve as classificatory devices. Therefore, a classification was devised empirically to handle our material. If it seems to be too elaborate the justification for it is that smaller units may be grouped to form larger in case our criteria do not appear to be diagnostic. Large groups cannot be broken down into smaller if only the distinguishing criteria for large classes are given.

1. *The General Form or Outline of the Edges of the Point.* There are seven types in this class indicated by the Roman numerals I through VII. Type I has convex sides, commonly called leaf shaped. Type II has straight sides, commonly called triangular. Type III has concave sides. Type IV has a combination of concave and convex; concave from the tip to a point near the mid-part of the side, then convex in the after section. Type V is the reverse of Type IV being convex or

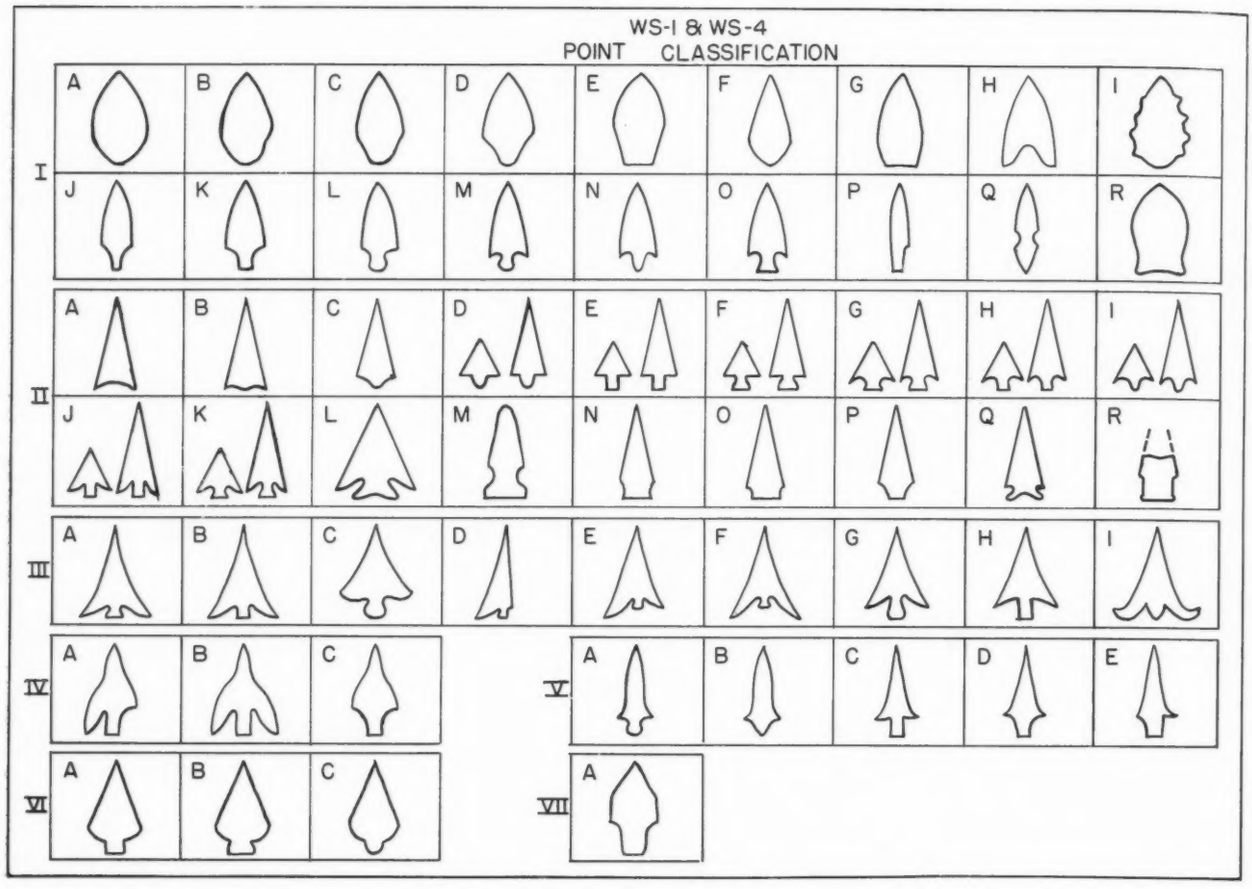


FIG. 19. Projectile point types.

straight from the tip back, then becoming concave in the after parts. This concavity, producing almost a point, is in most cases quite abrupt, projecting sometimes only slightly, from the side of the point. Type VI is a combination of straight and convex, straight from the tip back, then bulbously convex toward the proximal end to the juncture with the stem. Type VII is a combination of straight sides, roughly parallel toward the proximal end in front of the stem, then converging to a point at the distal end.

2. *The Form of the Stem.* Three forms are found: (1) Converging toward the proximal end. (2) Parallel sides. (3) Expanding toward the proximal end.

The base of the stem shows three forms, straight, concave, or convex. The form of the base is considered only in a few outstanding cases, since its use would greatly increase an already extensive typology without convincing evidence of justification.

3. *The Form of the Juncture Between the Side and the Stem of the Point.* Four forms are found. The first is a shoulder or a 90° angle between the side and the stem. The second, an incipient barb, is a concavity between the side and the stem. The general situation is for the point of juncture between this concavity and the side, the incipient barb, to fall below the distal end of the stem. The third form, a barb, has a convex edge from the barb point to the stem, with the proximal limit of the side below the distal end of the stem; barbs vary in length.

4. *A Notch taken out along the Side.*

The use of these criteria made it possible to include fragments of points which had otherwise lacked enough distinguishing features. A great many points lack symmetry and they are classified as distinct types, where more than one specimen was found or known of.

For matters of simplification the variations, within the seven types, are given letter designations. This use of letters is not intended to show relationships between letter designations across main classes.

DESCRIPTION OF TYPES

(Fig. 19)

Type I points; convex sides; 17 forms (fig. 41*a*).

I-A Ovate and stemless; proximal end generally rounded; small, ranging from 22 to 26 mm. long and 9 to 13 cm. wide.

I-B Ovate with proximal end formed by a slight indentation on one side: converges toward the proximal end; largest point is 51 × 24 mm., the smallest is 20 × 9 mm.

I-C Similar to I-B except that there are depressions on both sides making it symmetrical; convex sides, a converging stem, a rounded butt; size ranges from 17 to 27 mm. long to 8 to 12 mm. wide.

I-D Similar to I-C except that the stem has concave sides and has a more pronounced point of juncture between the side and the stem; very often has a slight shoulder; size ranges between 27 and 34 mm. long and 12 and 16 mm. wide.

I-E Stem converges toward the base with either straight or slightly convex edges; slight basal notch; one specimen was found measuring 32 × 19 mm.

I-F Slightly convex sides with maximum width between the midpoint and the base; from the widest point the sides converge with convex edges to the proximal end; the shorter the distance from the widest point to the base, the greater the convexity; size range is 73 × 29 mm. to 36 × 14 mm.

I-G Convex sides, straight across the base with widest point forward of center; this type includes both wide and narrow specimens and varies from 33 to 48 mm. long and 26 to 16 mm. wide.

I-H Convex sides with the widest part near the base; represented by one fragmentary specimen; has deep basal notch forming a long barb (a similar barb was probably broken off); size is 70 × 3 mm.

I-I Ovate, pointed at distal and rounded at the proximal end; deeply serrated edges; two points measuring 30 × 16 and 22 × 11 mm.

I-J Shouldered with a converging stem; fragments of this type found in excess of 28 mm. long and 18 mm. wide; most specimens are smaller ranging from 17 to 22 mm. long and 6 to 12 mm. wide.

I-K Shouldered with a parallel (or roughly parallel) stem; size ranges from 17 to 31 mm. long and from 9 to 18 mm. wide, including both wide and narrow points with a continuous series in between, making it difficult to distinguish between all but the extremes.

I-L Shouldered, expanding stem with either straight or convex base; size ranges from 13 to 32 mm. long and 6 to 9 mm. wide.

I-M Incipient barb with expanding stem and convex base; size ranges from 22 to 24 mm. long and 9 to 10 mm. wide.

I-N Incipient barb and converging stem; size range is 27 × 14 mm. to 15 × 8 mm.

I-O Incipient barb, parallel or slightly expanding stem, straight base; several fragments and one complete point are represented measuring from 21 mm. plus long to 9–11 mm. wide.

I-P Shoulder on only one side, long converging stem, straight; one specimen is 70 mm. long × 15 mm. wide.

I-Q Side-notched point with the notches near the center; base similar to the tip, except notches are to rear of midpoint.

I-R Small, constricted waist point; sides convex, flaring rapidly from a blunt tip, then narrowing to a constricted waist and flaring again to a stem nearly as wide as the body. The sides of the stem are rounded and the base is concave. Not illustrated.

Type II points; straight sides; 17 forms (fig. 41*b*).

II-A Concave base, sub-triangular; 36 × 13 mm.

II-B Two basal notches, one on each side of center; largest is 38 × 20 mm. the smaller range from 15 to 23 mm. long and 8 to 16 mm. wide.

II-C Short barb or shoulder, converging stem that forms nearly a right angle; 15–28 mm. long and 9–20 mm. wide.

II-D Straight shoulder, converging stem not always coinciding with long axis; both narrow and wide points occur; narrow points have a converging angle, at the stem of between 25 and 35 degrees; the wide points have an angle from 40 to 75 degrees; narrow points are 18–24 mm. long and 9–10 mm. wide; wide points vary from 14 to 21 mm. long and 10 to 16 mm. wide.

II-E Straight shouldered, parallel-sided stems, straight or convex at the base; both narrow and wide types occur; narrow points range from 12–15 mm. long and 5–7 mm. wide to 18–30 mm. long and 7–9 mm. wide; really two sizes in terms of length-breadth ratio; wider points (those with angles greater than 40 degrees) range from 15 to 22 mm. long and 9 to 15 mm. wide.

II-F Straight shouldered with expanding stems; base either straight or convex and in a few cases notched (both wide and narrow varieties); largest of narrow variety is 40 × 13 mm. while the smaller narrow points are 17–25 mm. long and 9–12 mm. wide; largest of the wide points is 33 × 21 mm. while the smaller are 13–19 mm. long and 9–13 mm. wide.

II-G Incipient barb expanding stem, usually straight base; both narrow and wide types; narrow variety 17–27 mm. long and 9–14 mm. wide; wider range 14–18 mm. long and 13–16 mm. wide.

II-H Incipient barbs, parallel-sided stems, base either straight or convex; both narrow and wide types, narrow are between 20 and 27 mm. long and 7–12 mm. wide; several large rear portions of this variety are 24 mm. wide and have converging angles of 30–85 degrees; wide measure 15–22 mm. long and 11–16 mm. wide; two small points are 9 × 9 and 12 × 9 mm.

II-I An incipient barb, converging base; one narrow point was 33 × 15 mm., wider points 13–21 mm. long and 11–16 mm. wide.

II-J Short barb, parallel-sided stem, either straight or convex base; two narrow points measured 26 × 15 and 21 × 13 mm.; wider points were 15–24 mm. long and 12–15 mm. wide.

II-K A short barb, expanding stem, either straight or convex base; wide and narrow variations are found, with the narrow variety 21–25 mm. long and 9–16 mm. wide; wide variety ranges from 15 to 22 mm. long and from 12 to 19 mm. wide; several large, wide fragments were found, of which the measurable pieces were up to 34 mm. long and 23 mm. wide.

II-L Long barb, expanding stem, shallow concave base; most specimens are fragmentary; nearly complete points measure 30 × 25 and 22 × 19 mm. though some fragments appear to be from larger points; one small point is 16 × 16 mm.

II-M A side notch near the base of the point; the stem is a continuation of line of side; a straight, concave or convex base; the tip of the point is, in all cases, quite blunt; one small point is 20 × 6 mm., the larger are 25–31 mm. long and 13–17 mm. wide.

II-N A wide shallow notch on each side to produce stem which is wide and expanding; slightly concave base; one large point measures 51 × 20 mm. the smaller measure 16–21 mm. long and 6–10 mm. wide.

II-O A wide shallow corner notch to form a wide parallel-sided base; two fragments of this type, large measuring 17 mm. and over 20 mm. wide (the tips are broken); a small point is 7 × 15 mm.

II-P Wide shallow corner notches with converging stem, either straight or convex base; size varies from 15 to 27 mm. long and 8 to 12 mm. wide.

II-Q Notched low on the side, expanding stem, concave base; size ranges from 26 to 29 mm. long, 20 to 21 mm. wide; fragments of smaller points occurred.

II-R The base of a Scottsbluff-like point found in Level 28; the sides of the blade appear to have been straight then converging to point; shouldered, straight-sided stem; straight base projecting in points on each side. Not illustrated. Single specimen.

II-S Also from Level 28, triangular in shape, 50 mm. long, and 25 mm. wide at base, all edges are straight; the basal corners slightly rounded; the base an unmodified fracture, except for minute flaking along edges. Not illustrated. Single specimen.

Type III points; concave edges; 9 different forms (fig. 41*c*). Many points of this and other barbed types have broken barbs and had to be classified by assuming that if the surface where the break occurred is the same measurement as a similar section through the remaining barb, then the point would have originally been symmetrical.

III-A Barb extending to proximal end of expanding stem; a straight or slightly concave base; points of this type measure 18–26 mm. long and 13–18 mm. wide.

III-B Barb extending to the proximal end; parallel-sided stem; the most nearly complete example of this type measures 14 × 19 mm.

III-C Very short barb extending almost straight out from expanding stem and turning upward slightly at the tip; one large point with broken tip measures 26 mm. wide; smaller points, some broken, vary from 12 to over 17 mm. long and 11 to 15 mm. wide.

III-D Asymmetrical; a barb on the end of the concave side, and a slight shoulder on the other side at the juncture of the straight edge with the stem; two of the four points in this class do not have a concave edge, but they were placed in this type because of their asymmetrical character; stems on three of these points expand while the other converges; one large point is 33 × 17 mm.; smaller points 17–20 mm. long and 10–13 mm. wide.

III-E One long and one short barb, the longer extending beyond the base of the stem; because of broken barbs it is difficult to know how many points were originally of this form; one unbroken point measures 25 × 17 mm.

III-F Long narrow barbs, both extending beyond the distal end of the stem, which is small and expanding; points are nearly all fragmentary, measuring 26 mm. long and from 19 to more than 22 mm. wide.

III-G Medium length barbs not extending to the level of the proximal end of the stem; expanding stems, straight base; two long narrow points measure 39 × 15 mm. and 32 × 17 mm. Others are without tips, varying from 15 to 21 mm. wide and are at least 15 mm. long.

III-H Incipient barbs and generally parallel or slightly expanding stem, straight base; measure 18–27 mm. long and 12–16 mm. wide.

III-I Medium length barbs which turn up slightly at the tips; stems on the points found were not complete but suggestions are of a long stem which converges and a short stem which expands; two points which measure 16 × 15 mm. and 20 × 13 mm.

Type IV points; eccentric borders, concave from the middle to the tip and convex on the proximal portion of the edges; three forms; stem was not used as a criterion for Type IV points, but they either expand or have parallel sides (fig. 41*d*).

IV-A Long barb on one side and an incipient barb or a shoulder on the other; largest is 24 × 17 mm.; while the smaller points are 12–19 mm. long and 10–13 mm. wide.

IV-B Barbs of equal length on each side. Points measured 30 × 23, 12 × 12, and 22 × 14 mm.

IV-C This form is symmetrical and has slightly forward sloping shoulders; size range is 15–20 mm. long and 8–11 mm. wide.

Type V points; the characteristic feature is a sharp projection on the edge at the distal end of the stem. There are five form (fig. 41*d*).

V-A Varies in convexity on the edges becoming straight in some instances; shouldered, expanding stem; in some instances the stem is diamond shaped. The largest of these points is 30 × 11 mm., smaller points range from 18 to 26 mm. long to 6 to 10 mm. wide; all are long and narrow.

V-B Convex edges with a slight shoulder projection and triangular, converging base; measure 32 mm. long and 13–15 mm. wide.

V-C Straight to concave edges with an incipient barb and slightly converging base; two points of this form were found measuring 38 × 17 and 21 × 14 mm.

V-D Straight sides, shouldered, converging stem; base may be straight, pointed, convex; they measure 21–32 mm. long and 12–16 mm. wide.

V-E Straight edges with a shoulder on one side and a protruding incipient barb on the other; two points measured 28 × 11 and 24 × 13 mm.

Type VI points; straight at the distal end and convex or rounded at the proximal end of the edges. This could, perhaps, be called a rounded shoulder. Three forms of Type VI occur (fig. 41*d*).

VI-A Parallel-sided stem, base either straight or convex; size range 16–23 mm. long and 7–12 mm. wide.

VI-B An expanding stem, base either convex or straight, range 15 to 19 mm. long and 5–14 mm. wide.

VI-C Converging stem; points of this type vary from 16 to 18 mm. long and 12 mm. wide.

Type VII is represented by one point. This point has roughly parallel edges which form an obtuse angle with a triangular-shaped tip. It is shouldered, has a slightly converging stem and a shallow basal notch. It is 27 × 15 mm. This type occurs in considerable numbers further upstream (fig. 41*d*).

BIFACE CHOPPERS

(Figs. 26, 50*b*)

BC-1 Chert core blank; alternate percussion flaking (zigzag); ovoid form, lozenge to triangular cross section, convex chopping edge.

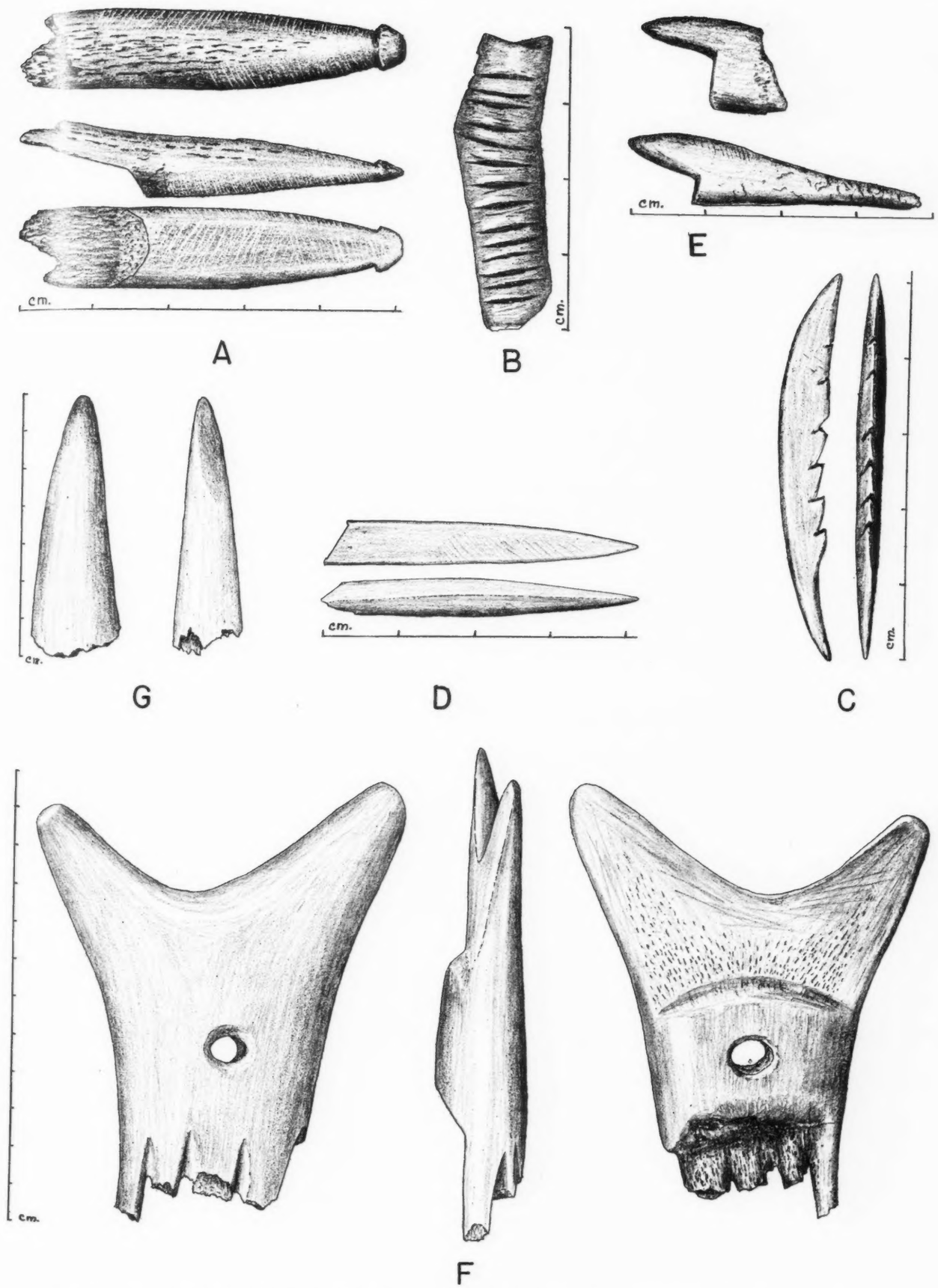


FIG. 20. Bone and antler artifacts, WS-4, Roadcut. A. Harpoon prong. B. Carved bone. C. Harpoon section. D. Unknown. E. Atlatl spurs. F. Unknown. G. Flaker.

BC-2 Chert and petrified wood flake; alternate percussion flaking, percussion retouch on chopping edge, angular form, rectangular cross section, straight chopping edge.

BC-3 Petrified wood and chert flakes; percussion flaking; percussion and pressure retouch on chopping edge; triangular to semi-lunar form and lozenge to rectangular in cross section; convex chopping edge.

BC-4 Chert flakes, alternate percussion flaking; very crude.

BC-5 Large primary chert flakes having few secondary flakes struck off by percussion; use-flaking on chopping edge; one specimen has been re-used with former cutting edge water-worn.

BLADES

Two general types of blades were found, those bifacially and those unifacially flaked. Class A are bifacially flaked (fig. 42) and class B are unifacially flaked (fig 43).

Type A. Bifacially worked blades occur in fifteen different forms. Most forms have had large primary flakes removed by percussion and finished by pressure retouching. Others consist of percussion flaked blades with no secondary flaking.

A-1 Convex borders converging at the tip; base straight; widest part of the blade is at the base or very near it; blades thin, maximum thickness of 6 mm.; flaked secondarily; vary from 54 to 70 mm. long and 28 to 33 mm. wide.

A-2 Convex borders, converging at the tip, base concave; one specimen only; both primary and secondary flaking, and measures 131 × 41 mm.; widest part is 20 mm. from the base, from where it tapers slightly toward the base.

A-3 Similar to A-2 except that it flares out near the base, then tapers in giving the appearance of bulging; base is concave, one specimen only, measurements are 122 × 39 mm.

A-4 Convex sides converging at both ends. One nearly complete blade only; crudely worked with small amount of secondary flaking; measures 72 × 25 mm.

A-5 Asymmetrical blades of varying forms; both percussion and pressure flaking represented.

A-6 Roughly rectangular in shape, with both primary and secondary flaking; all blades of this type are fragmentary, lacking one end; they measure 23–32 mm. wide and are at least as long as 46 mm. Several crude blades which have only percussion flaking were found and would probably fit into form A-6.

A-7 Slightly convex sides and straight or slightly convex at the ends; flaked on both edges but none on the surface; 44–51 mm. long and 24–29 mm. wide.

A-8 Oval in shape, pointed at one end and broken at the other on both of two specimens found; differ from some kinds of projectile points only in their great width; measure 30 × 39 mm. and 37 × 43 mm.

A-9 Bifacial percussion flaking and retouch, symmetrical, parallel sides, convex base or base unfinished.

A-10 Thin, symmetrical blades. Body shaped by percussion flaking; edges bifacially pressure flaked. Tip angle 75–80°. All fragments.

A-11 Semi-lunar blade from core blank, percussion and pressure flaking, biface edge pressure retouched (Eskimo Ulu form); two fragments, one complete: 85 × 58 × 10 mm.

A-12 Core blank, asymmetrical point, 68° angle, parallel sides, convex base, percussion and pressure flaking; biface edge secondarily flaked by pressure; 90 × 45 × 15 mm.

A-13 Core blank; percussion flaking, percussion retouch, elliptical to ovoid form, lozenge section; basalt; one fragment; two complete are 54 × 48 × 20, 54 × 42 × 18 mm.; possibly used as a chopper.

A-14 Core or large flake blank shaped by percussion flaking; edges retouched by pressure flaking; ovoid; identifying character is a large hinge flake scar leaving a semi-circular indentation on one side near one end, presumably the base; two complete specimens are 111 × 62 × 12, 72 × 51 × 11 mm.

A-15 Small blades made by pressure flaking on flake blanks; thin, varying from triangular to roughly diamond shaped having one or more sharp corners.

Type B. These blades are made from large thin flakes such as conchoidal or lamellar flakes, and are flaked only on one face. In some cases flaking occurs on one face on one edge and on the opposite face on the other edge.

B-1 Two concave cutting edges with both primary and secondary flaking; one blade is 58 × 21 mm.

B-2 Made principally from lamellar flakes having one concave cutting edge while the other is either straight or convex; flaking varies from a combination of primary and secondary flaking to simple primary flaking; both forms are often found on one blade; length varies from 35 to 58 mm. and width from 14 to 25 mm.

B-3 No specific shape but the class consists of a group of large flakes which have been flaked both primarily and secondarily or else have simple pressure flaking along the edge or have a combination of both; concave, straight and convex cutting surfaces are found; large blade of this type is 72 × 35 mm. but it is difficult to fix a minimum limit since it is not certain whether some of the smaller pieces are fragments.

B-4 Generally smaller than previous types (and have a keener cutting edge), elliptical in shape; sometimes pointed at one end; measure 38–39 mm. long and 18–23 mm. wide.

B-5 This form has a combination of bifacial with unifacial chipping; bifacial chipping is slight; type is roughly T-shaped with both primary and secondary flaking; on one specimen the principal cutting edge is concave with a few large flakes removed from both sides and secondary flaking on but one face.

B-6 Large flat short flakes; unifacial percussion flaking, pressure retouch; serrated cutting or scraping edge; serrations 4–9 mm. wide with concave part secondarily flaked by pressure. (Spokeshaves in miniature); flaking angle 15°–30° from perpendicular.

B-7 Sub-conchoidal flake, ovoid convex-concave, positive bulb of percussion on concave side; unifacial percussion flaking with pressure retouch around the edge; resembles a tortoise-shell prepared flake (Mousterian technique); smaller forms grade into keeled scraper class.

B-8 Crude chert end scrapers; large primary flakes; convex scraping end, pressure retouch on working edge only.

B-9 Primary prismatic sub-conchoidal flakes; sharply convex cutting edge opposite bulb of percussion, occasionally ending in a graving point; unifacial

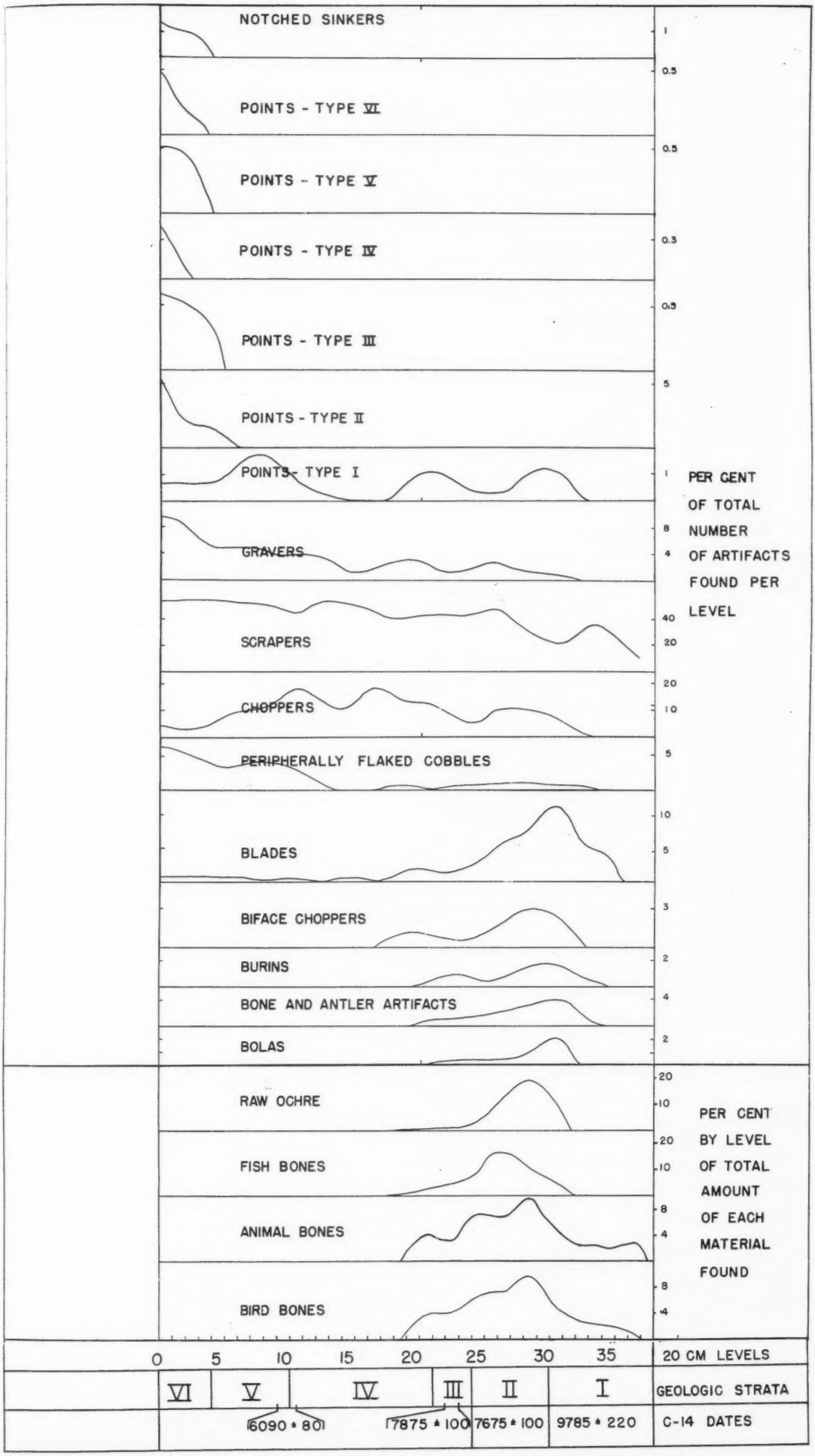


FIG. 21. Selected cultural, geological, temporal, faunal aspects, WS-4, Roadcut.

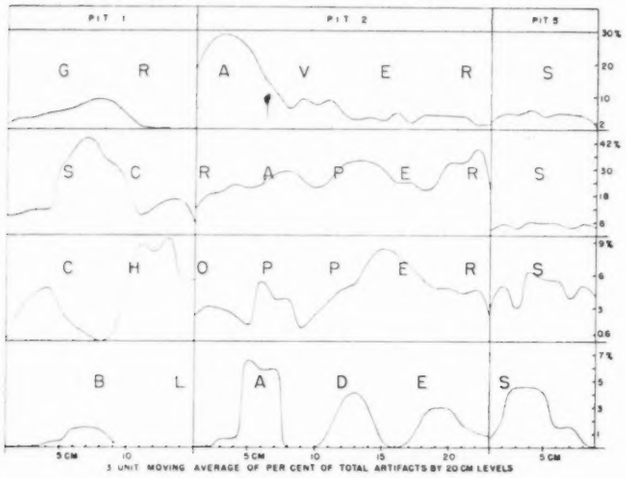


FIG. 22. Selected artifact types; percentage by levels, Pits 1, 2, 5.

pressure retouch along opposite edge which is straight; convex edges are bifacially flaked.

B-10 Semi-lunar scraper made from sub-conchoidal primary flake; unifacial pressure retouch on working edge only; working edge is half circle at or near bulb of percussion.

KNIVES

The distinction made here between knives and blades is primarily one of size, with the term knife being applied to small cutting tools and blades being used in the case of large cutting tools. In the case of knives, however, there are some characteristic features which would separate them from merely diminutive examples of the previously described blades. Many blades have a characteristic form such that if a small replica is found it is considered a point or an end scraper.

Two general types of knives are found, those worked bifacially and those worked unifacially.

Bifacially worked knives are found in shapes which might be described as roughly triangular or roughly oval, with the cutting edge, in most cases, rounded. Shaping is by both primary percussion and secondary pressure flaking. The crudeness of some of the percussion flaking and unevenness of the pressure flaking suggests that not a great deal of time was spent making them.

Bifacial knives are of two kinds, those worked on the greater part of the edge and those which may or may not be fragments, but are rounded on one side and have a broken edge on the other. Measurements are 22–40 mm. long and 17–28 mm. wide.

Unifacial knives have either convex or nearly straight edges. The cutting edge is either percussion secondary flaking or simple pressure flaking. They are 17–42 mm. long and 9–21 mm. wide, with flaking, in most cases, around the entire edge of the knife.

Another unifacial tool which might be called an end knife, or perhaps a gouge, is shaped on the greater part of the edge with flaking about 15 degrees off perpendicular to the long axis of the tool. Measurements are 20–33 mm. long and 13–24 mm. wide.

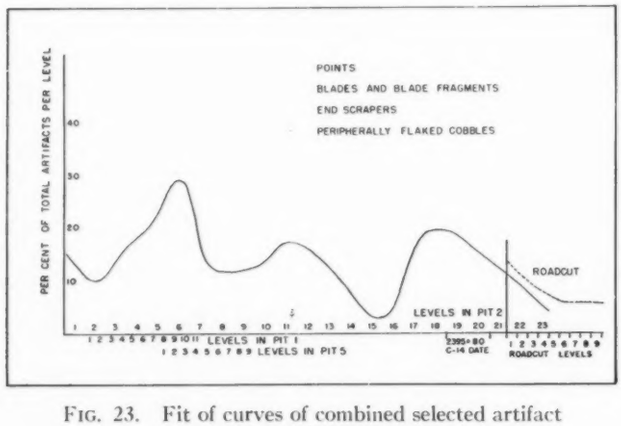


FIG. 23. Fit of curves of combined selected artifact types of pits and Roadcut, WS-4.

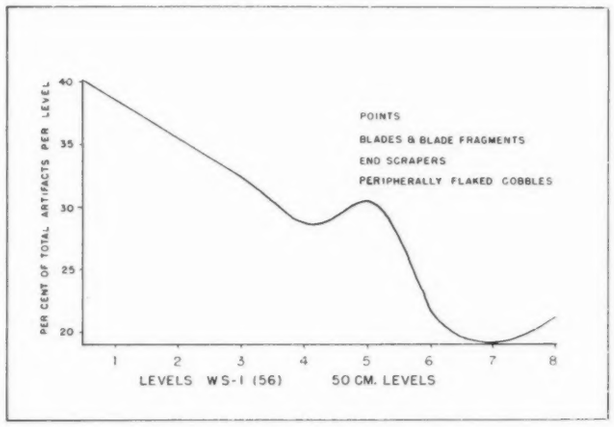


FIG. 24. Selected artifacts, distribution of combination of types by levels, WS-1, 1956.

BURINS

Burin types are distinguished on the bases of two criteria: (1) the method of shaping the tip, and (2) the relation of cutting face of the tip to the plane of the body of the tool (figs. 25, 44).

1. Angle burin; burin tip a shoulder angle made by detaching a flake with the burin blow, tip face at right angle to plane of the body, tip secondarily flaked, tip edge straight. Body range length: 41–88 mm., average 56 mm.; tip width: 1.6–4.3 mm., average 2.0 mm.
2. Angle burin or utilized natural fracture at right angle to plane of the body. Tip bifacially flaked or natural angle forming a triangular cutting tip.
3. Burin 1 type with cutting tip parallel to plane of body; tip formed by intersection of two flake scars, only modification is at cutting tip; length 67 mm., width of bit 2 mm.

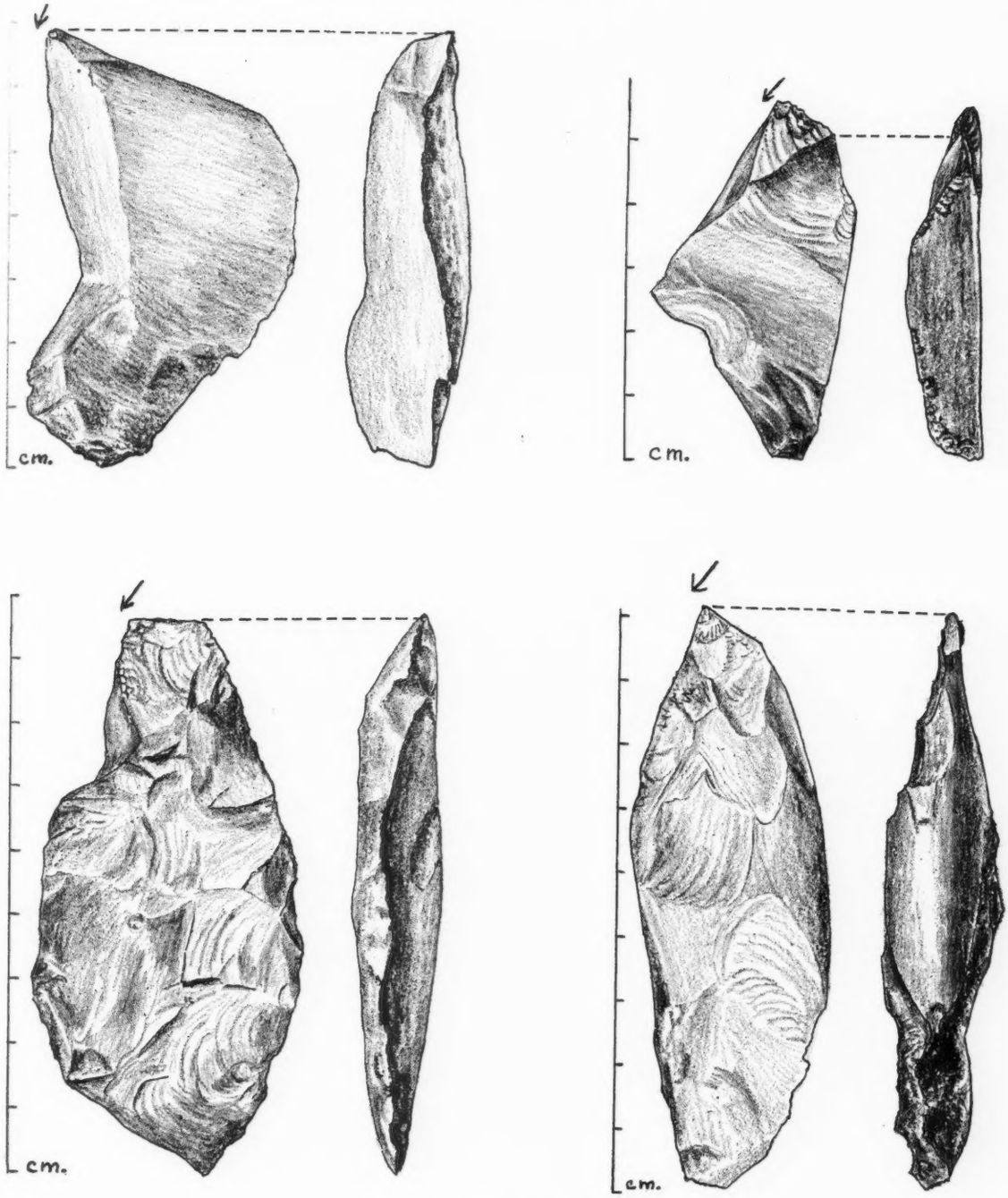


FIG. 25. Burins, WS-4, Roadcut.

BURIN-LIKE TOOLS

Five flakes, three above hardpan and two from below, are unmodified flakes showing no specific shape. They are alike in having sharp corners or projections with minute use flaking. These projections form a right angle to the plane of the body and were probably used as burins.

The question has been raised from a number of sources whether these objects classified as "burins" are really such. Therefore, when Dr. L. S. B. Leakey recently visited the Department of Anthropology and examined samples of the WS-4 materials, I asked him as a specialist conversant with European paleolithic typology to give me his opinion on the nature and func-

tion of the specimens we called "burins." He kindly examined some of them and prepared the following statement under date of October 24, 1959, for my use.

I examined some of the specimens which have been classified as burins and which came from the site.

There are specimens which are burins of the "burin simple" type in the French classification. These are true burins in which one side of the burin is made by a fracture, while the other exhibits the removal of distinct small burin spalls to make a suitable cutting edge. These specimens, moreover, exhibit signs of usage; I have no doubt that they were used to cut the antler material which was found in association with them.

There are other specimens which would not qualify as burins in the European sense but which are also adapted for similar usage and show signs of such use.

SCRAPING TOOLS

End Scrapers. Scrapers which have a cutting or scraping edge near the widest end with some provision made at the other end for hafting; all bifacially flaked, both primarily and secondarily; occur in eleven forms.

ES-1 The widest part is toward the distal end near the mid-point; from here it tapers slightly to the end which is straight. From the widest part of the shank it is narrowed sharply for 2 or 3 mm., then tapers to a point at the proximal end; two specimens are 54 × 27 mm. and 52 × 28 mm.

ES-2 The widest part of this form is toward the distal end from the mid-point; the scraping end tapers inward slightly to a straight cutting edge; the shank tapers evenly, in contrast to the abrupt narrowing of ES-1, to a point. One complete point measures 51 × 32 mm.

ES-3 Specimen is shovel shaped, with a shank having roughly parallel sides which expand about midway to the widest part and then taper slightly toward a straight end. One specimen in this category; measurements are 55 × 28 mm.

ES-4 This form has convex scraping end which starts from the widest part of the scraper. Just back of the scraping end it is narrowed sharply to form the shank, which tapers to a point at the proximal end. Only one scraper of this form was found; measurements are 42 × 33 mm.

ES-5 This form, represented by two fragments, has the widest part near the distal end which is concave, and tapers back (probably to a point) at the proximal end. The fragments are 31–35 mm. wide and 35–44 mm. long.

ES-6 This form is widest at the distal end, which is concave, from which it tapers back slightly to about midway, then sharply to a point at the proximal end; one specimen only and it measures 54 × 35 mm.

ES-7 This form, represented by one specimen, has convex edges which form a point at the proximal end and is widest at the scraping concave end; it measures 48 × 35 mm.

ES-8 Convex edges coming to a point at the proximal end; greatest width at the distal end, which is slightly convex; measurements are 22–31 mm. long and 12–16 mm. wide.

ES-9 Fairly straight edges converging to a point at one end with greatest width at the straight or slightly convex scraping end; isosceles triangle in shape; measurements are 16–38 mm. long and 13–26 mm. wide.

ES-10 Concave sides and convex scraping end; widest point at the distal end; proximal end is pointed; measurements are 32–33 mm. long and 19–20 mm. wide.

ES-11 Large hinge flake; flat, rectangular, sides roughly parallel, serrated cutting or scraping edge slightly convex; opposite end may have been flaked also, but chipped off and blunted.

Snub-nose Scraper (fig. 45, H–J). Large chert flake, core side plano-convex, cortical side convex prismatic; keeled, unifacially pressure retouched on working end; tear drop or leaf-shaped plan view; large secondary flakes 1–6 mm. wide removed around scraping end, then edge finely retouched, scraping end steep, 25° off vertical. Well used.

Bi-convex Scrapers. Two forms of bi-convex scrapers are found; (1) those having both primary and secondary flaking, or simple pressure flaking on each side, and (2) crude percussion flaked bi-convex scrapers; form 2 may be worked on all edges or on only one edge; size is highly variable; form 1 may be 10–30 mm. long, while form 2 is not as small—varying from 25–70 mm. in length.

Plano-convex Scrapers. This type has the same variations as described for bi-convex. Bi-convex and plano-convex scrapers which are percussion flaked are referred to as crude scrapers.

Flake Scrapers. Sub-conchoidal fracture; core surface plano-concave, cortical convex-prismatic; positive bulb of percussion has flaking along edge.

Side Scrapers. Sub-conchoidal fracture; core surface plano-concave, cortical convex-prismatic; positive bulb of percussion; edge flaked on one side, working edge not shaped.

Plane Scrapers (fig. 53*a*). Two types of large tools which appear to have been used like planes were distinguished.

Plane-1 (fig. 53*a*, B, C, F): Group of stone tools characterized by a flat base with polished surface or wear facets on high spots and steep percussion flaking around part or all of the edge. Edge angle is 90°–45°. Shape varies from talus blocks identical to "pulping planes" (Rogers, 1939) through modified river cobbles to cores similar to keeled chopper scrapers. Secondary flaking is rare; only extensive use shown is on two of the core specimens.

Plane-2 (fig. 53*a*, A, D, E): Oval water-worn cobbles fractured along a bedding plane; fractured surface is working surface and shows some polishing; edges lapped from abrading. Usually large flakes struck off one end, producing a steep angle; edges sometimes show signs of pulverizing; one specimen has steep flaking also on the sides.

Keeled Scrapers (fig. 45, D–G). This tool is made from a large sub-conchoidal chert flake with the roughly prismatic cortical surface secondarily flaked into a keel; the convex scraping edge is retouched by pressure flaking. Workmanship ranges from crude to well-made

specimens bordering on the snub-nosed end-scraper type. Twenty-four specimens of this type occur in Levels 23–31.

Keeled Chopper-Scraper (fig. 45, A–C). This is a very crude tool made from chert cores or flakes with keeled cortical surface; flaking is by percussion with minor retouching or possibly use flaking.

Compass Scrapers. These artifacts have two or more graving points in a row along one edge; serration is intentional since points are made by secondary flaking; artifacts called compass scrapers because it is possible to make dot-and-circle designs with them, but there is no evidence that they were used in this fashion.

Hafted Scraper. A slightly curved plano-convex blade with a parallel-sided straight base stem; unifacially flaked on the edges; end not retouched; one side forms a concave and the opposite a convex scraping edge; one specimen only, from Level 3.

GRAVERS, DRILLS, AND PUNCHES

Gravers. Fourteen variations of gravers are described. The criteria for distinguishing these variations are: (1) the length of the graving tip, (2) the width of the graving tip, (3) the shape of the cross section of the graving tip.

Most of the gravers found are made from a simple flake, which has been flaked only at the graving tip, and they vary considerably in both size and shape.

G-1 This variant has a quite narrow, long graving tip, 7–11 mm. long; it is flaked on one face; both edges of the point are worked, making it triangular in cross section; graving tip comes to a sharp point.

G-2 This form is narrow with a medium length graving tip, 3–6 mm. long; flaked on one face only, triangular in cross section and has a sharp point.

G-3 A unifacially flaked form with a pointed graving tip not more than 2 mm. in length and triangular in cross section.

G-4 This form has a short, wide graving tip 4–9 mm. wide; the end of the tip is blunt, either straight across or slightly rounded; worked only on one face and semi-circular in cross section.

G-5 This is a short graver with a blunt tip less than 3 mm. wide, worked on one face and is semi-circular in cross section.

G-6 This variant has convex sides converging to a blunt graving tip; it is flaked on one face and in cross section is rectilinear with sloping edges.

G-7 This variant is worked on one edge; the other edge is broken off at an acute angle to the worked edge, thus forming a sharp graving point; it is triangular in cross section.

G-8 This is a double pointed graver which may have any of the previously described graver tips. It has one tip on each of the opposite ends of the graver.

G-9 This form is a long flat flake chipped continuously along the edges. It has convex sides which converge to a blunt graving tip. The end opposite the tip has been broken off straight and is the only unflaked border on this artifact. These are worked both unifacially and bifacially and vary in size from 15 to 30 mm. long and from 6 to 12 mm. wide.

G-10 This variant is worked bifacially, is oval or round in cross section tapering into a blunt graving tip. It varies from 6 to 16 mm. in diameter in the widest parts.

G-11 This graver has a very broad tapering tip rounded on the end. It is flaked on both edges, of one face, and is semi-circular in cross section.

G-12 These are bifacial gravers either round or oval in cross section. The shape would correspond to those in the first five graver variations, e.g., G-1 to G-5.

G-13 Triangular graving tip modified by a burin-like notch at the tip. Length, 49–91 mm., average 59 mm. Width of tip above notch 1–3.8 mm.; average 2.5 mm. (fig. 46, A–D).

G-14 Conchoidal flake having blunt graving tip with triangular section, unifacial pressure flaking with normal flaking on one side of tip and steep, almost vertical flaking on the other side; flaked edges concave from graving tip to ends of the flake (fig. 46, E–F).

Drills. Five different variations of drills were found, all of which are diamond shaped or oval in cross section with parallel-sided piles and blunt rounded tips.

D-1 The stem on this drill has concave sides and a basal notch. The pile is approximately the same length as the stem. One complete specimen was 42 mm. long, 15 mm. wide at the stem, with a 9 mm. wide pile. A smaller fragment was 13 mm. through the stem and 6 mm. through the pile.

D-2 One specimen was found of this form. The stem on this drill has slightly concave sides tapering outward toward the base of the drill, the widest point; base is concave; total length is 41 mm. long, of which 14 mm. is the stem; the base is 18 mm. and the pile is 7 mm. wide.

D-3 This type has a parallel-sided stem with a slightly convex base; the pile is about half the total length; measurements of this type are 26–35 mm. long with stems 9–18 mm. wide and piles 5–8 mm. wide.

D-4 This type is stemless; sides are roughly parallel and base straight; size varies from 30 to 31 mm. in length and approximately 11 mm. wide.

D-5 The stem of this type expands gradually from the pile toward the base; measurements are 22–36 mm. long, 8–13 mm. across the stem and 4–7 mm. wide at the pile.

Punches. Four forms of punches are found. These punches or stone awls are long and thin with a sharp piercing end.

P-1 This form has a contracting base. It is worked on one face and on both edges and is semi-circular in cross section; specimens are 26–32 mm. long and 4–7 mm. wide.

P-2 This form expands toward the base. It is worked on one face and both edges; some specimens were made from fossilized wood; in cross section, shape varies from square to triangular; measurements are 34–37 mm. long and 4–5 mm. wide.

P-3 This form has a long tapering point flaked on both edges of one face; in cross section it varies from triangular to rectangular with sloping sides. This punch often is part of a large un-worked flake; measurements are 23–33 mm. long, and 4–5 mm. wide, with bases varying between 11 and 20 mm. wide.

P-4 This type is convex on one side and concave on the other, making a long, tapering, curving punch shaped like half a crescent; worked on both edges and one face. The widest part is at one end, from which it gradually tapers toward the tip. Punches of this type are 25–40 mm. long and 7–27 mm. wide at the widest part.

BOLAS

(Fig. 47)

Bola: Girdled. Pecked groove, 4–9 mm. wide, .3–1.4 mm. deep. Pecked in with a tool with a narrow, 1–4 mm., or pointed bit. One specimen with incomplete grooving, two with three-quarter grooves, one with cut groove from Level 4 are atypical. Size: length 26–50 mm., width 28–43 mm., thickness 16–36 mm.; average of seventeen: 42 × 36 × 25 mm.

Bola: Unmodified. Round to ovoid waterworn pebbles; no sign of purposeful shaping. Range in size: length 30–60 mm., width 18–55 mm., thickness 17–46 mm.; average size twenty-four specimens: 46 × 40 × 33 mm.

MISCELLANEOUS CHIPPED TOOLS

Chisels. These are small tools with roughly parallel sides that have a straight cutting edge. Some are flaked along the sides as well as the end, but others are worked only on the end. They are 5–7 mm. wide at the bit and are 18–30 mm. long.

Combination Tools. A number of combination tools were found. These are made from large flakes which have one or more graving tips, as well as flaked scraping or cutting edges. They are generally larger than most gravers, measuring 37–55 mm. long and 26–35 mm. wide.

Conchoidal Knives. These are flat stones which have been worked bifacially either entirely over both surfaces, or over both surfaces along the cutting edge, which, in either case, is rounded. Of three specimens found, one is round, 57 mm. in diameter, while the other two are worked on the end, and measure 67 × 45 mm. and 70 × 59 mm. All are made of shale.

WEIGHTS AND SINKERS

Plumb-bob-like in Shape. (fig. 48*a*). Large pear-shaped river cobbles occasionally laterally flattened, girdled at smaller end to form a knob for line attachment. Some variations in measurements are as follows: two specimens, length 155 mm.; widths 116 and 90 mm.; groove 22 mm. wide, 6 mm. deep; knob 62 × 60 × 14 mm. above groove; and length 90 mm.; widths 65 and 47 mm.; groove 15 mm. wide, 1–3 mm. deep. One excellent specimen of granite (fig. 48*a*, D) was also used as an anvil. It was the only one of the series found above the hardpan and appears out of context. It could have been found along the river by the later occupants of the site and carried in.

4-N Sinkers. (fig. 48*b*, E–H). Flat river pebbles with two pair of opposing notches.

2-N Sinkers. (fig. 48*b*, A–D). Flat river pebbles with two opposing notches.

Single Girdled Sinkers (fig. 48*c*). Large ovoid river cobbles girdled with pecked lateral groove.

Double Girdled Sinkers. One ovoid river cobble girdled both laterally and longitudinally; 58 mm. long and 52 mm. wide.

POUNDING STONES

(Fig. 49)

Mauls. Two kinds of mauls were found. The first, right, second from top, (fig. 49), is round in cross section and in profile tapers slightly toward one end which is rounded and battered. The widest end is fairly flat, perhaps from an old break. It is 106 mm. long and 54 mm. in diameter.

The second variety (fig. 49, lower left and center) has an enlarged rounded pounding end and two complete ones have two nipples on the proximal end above the constricted handle.

Another specimen (not illustrated) which could possibly be called a maul, is rectangular in cross section and has parallel or slightly tapering sides. It is battered on all the corners as well as the end, suggesting that it was swung like a hammer. Most specimens of this type are broken, but the longest is 126 mm. long. They are 52–60 mm. wide and 30–38 mm. thick.

Hammerstones (fig. 52*a*). Hammerstones are waterworn cobbles which bear signs of battering, presumably as the result of using the stone for pounding. Seven varieties occur.

H-1 These are spherical or oblong cobbles with battered edges, measuring 60–92 mm. in diameter, and are up to 147 mm. in length. In most cases, the oblong stones are battered on the ends.

H-2 A flat cobble battered on the side; fairly large, measuring up to 130 × 157 mm.

H-3 Smaller oblong pebbles than H-2 which show use of the end for light pounding or pecking; chips removed by battering, characteristic of the other hammerstones, do not occur here; the end appears to be pulverized.

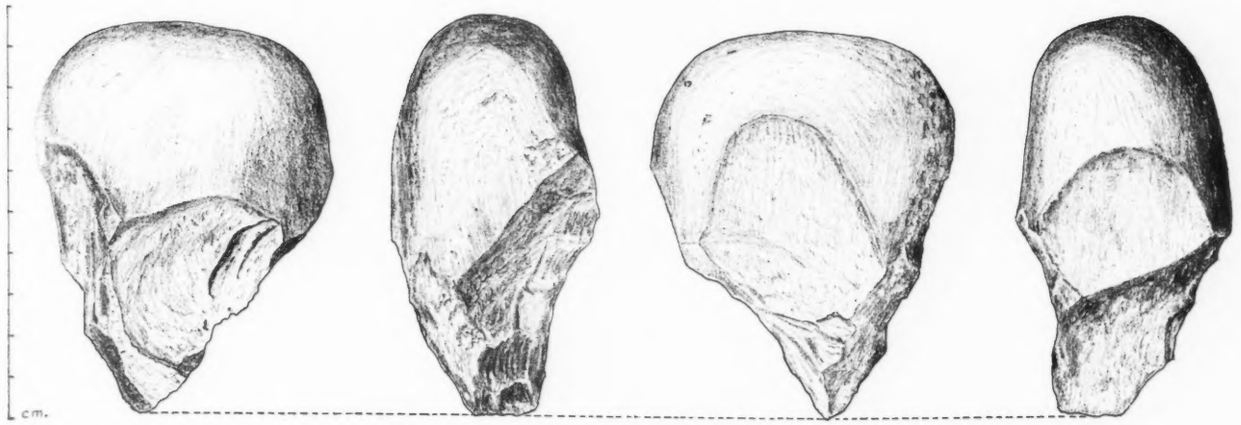
H-4 A fourth series is made of rocks of various sizes and shapes, which have battered surfaces, but many of these rocks are basalt or sandstone, or some material less dense than the other hammerstones.

H-5 A cobble which has been broken and the flat fractured surface used for pounding.

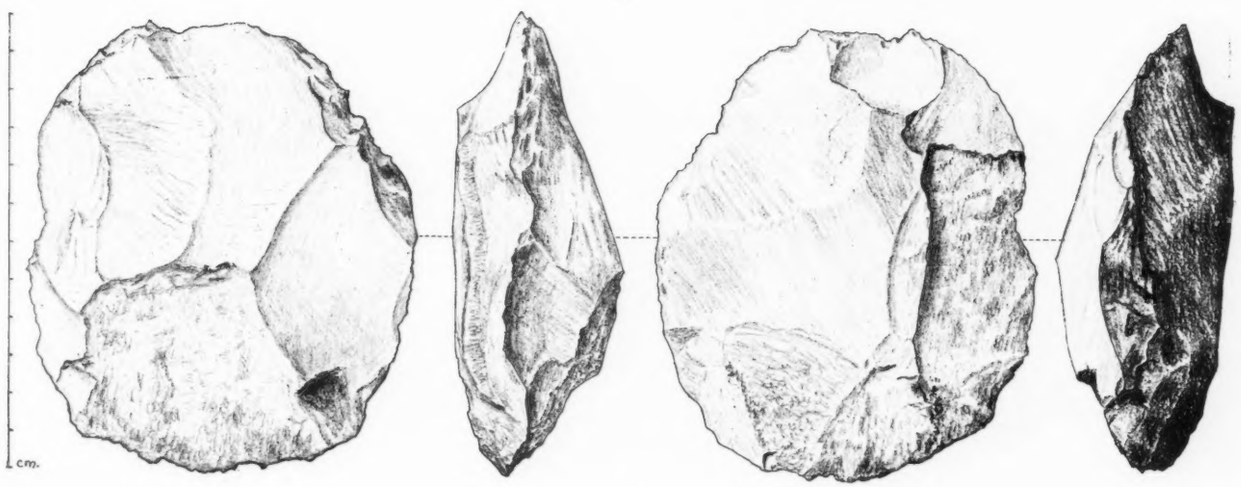
H-6 Thin, flat oblong to oval water-worn cobbles; edge battered all around, sufficient force to detach some flakes; sometimes edges are used for rubbing or pecking. Size: length 50–137 mm., width 43–119 mm., thickness 16–35 mm.; average of thirty-one 94 × 75 ×25 (fig. 52*a*, A–C).

H-7 River cobbles. Flat, oblong stones, used on edges, distinguishing characteristic is one or more indentations along the edges made by crumbling from use. Average size seven specimens: 126 × 96 mm.; range: length 92–140 mm.; width 77–119 mm. (fig. 52*a*, D).

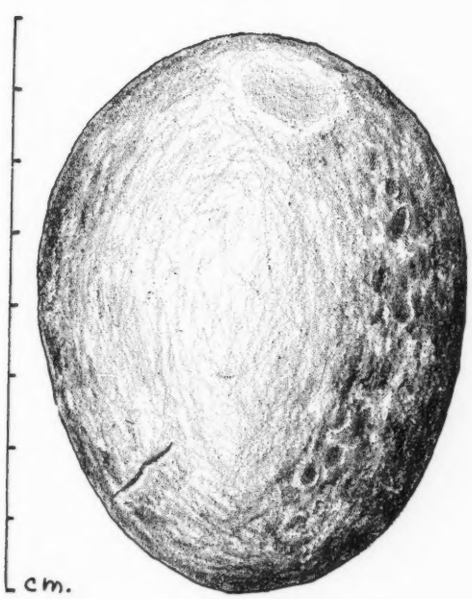
On many of the hammerstones there are slight depressions formed by many deep scratches in no particu-



a



b



c

FIG. 26. Reshaped choppers and polishing stone; WS-4, Roadcut. *a*. Pebble chopper. *b*. Biface. *c*. Faceted polishing stone.

lar direction. As many as four of these depressions may occur on a single hammerstone but the occurrence of two is more common. They usually occur on fairly flat surfaces, and are up to 40 mm. in diameter. Possibly these stones served as combination hammerstones and anvils.

With the exception of H-4 type these hammerstones are made from hard dense stone, such as andesite and quartzite.

CHOPPING STONES

Five varieties of choppers are found which are distinguished by the types of materials used and the nature of the chopping edge.

Class C Choppers.

C-1 A large water-worn cobble which had had large flakes removed from one face by percussion to form an acute convex chopping edge. Average size of fifty: 94 × 82 × 42 mm.

C-2 Large fragments of angular basalt of various shapes and sizes which have had a natural chopping edge which has either been battered by use or had large percussion flakes removed.

C-3 Water-worn cobbles which have been broken and the sharp edge used for chopping.

C-4 Crudely worked percussion flaked stone with a biface chopping edge.

C-5 A spall or cobble fragment with a sharp natural surface for chopping.

C-6 Flat ovoid river cobble; percussion flaking; bifacially flaked on both edges. Ends modified. Size: 97 × 60 × 29 mm.

C-7 Flat, oval river cobble; percussion flaking, bifacially flaked around entire circumference. Size: 63 × 55 × 28 mm.

C-8 Water-worn basalt cobbles, oblong unifacial percussion flaking as in C-1, but cutting edge is straight, and secondary flaking along edge. Bifacial in one instance; also definite evidence of use.

C-9 River cobbles, percussion flaking, percussion retouch, unifacial flaking, keeled. One specimen reused, former chopping edge water-worn, reworked into a gouge shape.

Peripherally Flaked Cobbles—identified by Indians as "tools used in skinning game." These are oblong, flat, water-worn cobbles flaked unifacially by percussion. The sizes range from 37–90 mm. long and 31–73 mm. wide.

CC-1 Nearly round and worked around the entire edge.
CC-2 Oblong and worked around the entire edge.
CC-3 Oblong and worked around the entire edge except for a small section at the end.
CC-4 Oblong and flaked on three edges.
CC-5 Oblong and flaked on one edge.
CC-6 Oblong and flaked over the entire face and full edge.

Biface Choppers. These are large percussion flaked biface cutting tools usually very crudely made (figs. 26*b*, 50*b*).

BC-1 Made from a chert or petrified wood core blank; ovoid with convex chopping edges and lozenge to triangular in cross section; chopping edges are flaked by alternate percussion flaking with minor percussion retouching.

BC-2 Made from chert or petrified wood flake blanks; rectangular both in form and cross section; chopping edge is straight and alternately flaked by percussion with percussion retouching.

BC-3 Made from chert or petrified wood flake blanks; triangular to semi-lunar in form and rectangular to lozenge cross section. The body is dressed by percussion flaking, and the convex edge is shaped by percussion flaking with pressure retouching; occurs from Levels 21 to 31.

BC-4 Made from chert flake blanks. It is oval in shape and the convex edge is alternately flaked by percussion. One specimen from Level 13, the other eighteen from Levels 20–32.

BC-5 Made from a large primary chert flake; elliptical in form, with a few secondary percussion flakes taken off around the edges; use flaking is also evident; the two specimens of this type come from Level 37. One is a reused knife, the former cutting edge is water-worn.

Proto-adze Choppers. This name is somewhat hesitantly used. They are made from water-worn basalt rocks. The chopping edge is unifacially percussion flaked as in C-1, but the edge is straight rather than typically convex, and secondary flaking along the edge is evident. One specimen is bifacially flaked. There are also definite signs of use. Levels 25–31 (fig. 50*c*).

Pebble Choppers. Figure 50*a* shows a collection of classic pebble choppers. They are unifacially flaked, keeled choppers made from river cobbles. The chopping edge shows percussion retouch. One specimen is reworked from a former chopper which shows signs of sand scouring or water smoothing. The chopping edge is modified almost to a blunt gouge (figs. 26*a*; 50*a*, A).

UNCHIPPED STONES

Anvils. Usually a large rock with a flat working surface which has been scarred by battering or scratching.

Painted Rocks. These are angular basalt pieces which have on them pigments of red, orange, yellow, or green; the flat rough surfaces were probably used for grinding pigment. Two unusual pieces covered with red pigment seem to go together; one is a long narrow polished stone, 46 × 12 mm. which fits into a groove running diagonally through the other. This other piece is either ground down or water-worn and is 30 mm. long.

GROUND STONE
(Fig. 49)

Pestles. One complete pestle was found which was broken by a drag line when scraping the face of the road cut. It is cylindrical, tapering slightly toward the handle. The handle has a circular enlargement near the grasping end which is wedge-shaped and slightly concave across the end. It is 515 mm. long and is 60 mm. in diameter.

Pestle fragments were found ranging from 44 to 68 mm. in diameter.

Mortars. Several small cobbles were found with polished concavities and identified as mortars; they

measure from 40 to 69 mm. in diameter and have a 1–3 mm. depression. A large piece of angular basalt was found bearing a circular depression; several fragments of mortars with sculptured exteriors were found in the surface fill.

Milling Stone (fig. 52*b*). Mano: Flat, ovoid river cobbles, usually abraded on one side over ½ to ¾ of the surface. Edges sometimes used for hammering. Metate: Source large basalt talus blocks with at least one flat surface. Size range of four specimens: length 16–37 cm., width 19–28 cm., thickness 3–11 cm.; average 30 × 19.5 × 7 cm.

Oil Lamp. A fragment was found in the surface fill. It is thin and flat, has a rounded handle and a circular blackened depression.

Abrading Stones (fig. 52*b*). Source vesicular lava and pumice; polyhedral lava or pumice fragment with fluted or rounded abrading surfaces; possibly whetstones.

Side Polisher (fig. 51*a*). Flat, extended oval waterworn cobble of quartzite or basalt having one edge ground flat, to slightly concave in some cases, with grinding surface usually highly polished; opposite edge may show signs of light battering or pecking; size ranges are: length 127–165 mm., width 55–101 mm., thickness 29–49 mm.; average 143 × 83 × 38 mm.

Polishing Stone. Ovoid and angular cobbles with one to several polished or ground facets. Facets are oval, slightly concave and can appear anywhere on the cobble (fig. 26*c*).

Stone Flesher (fig. 51*c*, C). Flat pieces of basalt with roughly parallel or slightly tapering sides; having an asymmetrical polished convex bit. They measure 25–30 mm. across the bit and are 76–102 mm. long.

Pipes (fig. 57). Two carved undecorated steatite pipe bowls with flaring ends and no stems were found. Pipe fragments with incised lines were found.

A possible pipe of modeled unbaked clay is cylindrical with a longitudinal center hole. It flares slightly at one end where the hole is larger. It measures 78 mm. long and is 30 mm. in diameter.

PERSONAL ORNAMENTS

Beads (fig. 57). Made from both stone and bone. Beads are (1) flat circular with a central hole and are 2–4 mm. thick and 6–9 mm. in diameter, and (2) tubular with a longitudinal hole. The tubular variety is made from steatite. They range in length from 10 to 13 mm. and 6 to 10 mm. in diameter.

Pendants. These are flat, girdled steatite slabs approximately 12 × 44 × 8 mm.

POLISHED STONE OBJECT

(Fig. 57, top row, left)

This object is made of polished granite. It is flat on one side. In profile it is semi-circular and from a top view appears ovoid with squared ends. The top surface is slightly concave. A three-quarter groove runs through the mid-section. It measures 92 × 50 mm.

CRUDE STONE OBJECTS

Several pieces of roughly shaped stone appear to be unfinished pestles that have been shaped but not yet polished.

MISCELLANEOUS STONE OBJECTS

A fragment of centrally girdled axe or perhaps a club head with a battered end; measures 185 mm. long and 95 mm. wide across the end.

An oblong water-worn stone is girdled at one end and may be either a sinker or a hammerstone. It has two concavities pecked into it, one on each side. These are similar to those concavities found on anvils and many hammerstones. It measures 112 mm. long and 96 mm. in diameter.

A number of flat, key-shaped stone objects were found at WS-1 which have been called "Lucky Stones" (Shiner, 1951: 12–13). These are roughly triangular in shape, and have edges which in most cases, are broken off perpendicular to the plane of the surface, so would be unsuitable for scraping, cutting, etc. The sides on these objects are usually concave and the end is notched. They vary in size from 18 to 43 mm. long and 12 to 30 mm. wide.

CARVED BONE FRAGMENTS

Four minute fragments of bone were found which were worked. One had no marks on it. Another had an incised line on it, and two had carved geometric designs. All four are Late and come from the 1953 excavations and are completely out of context both temporally and culturally with the bone and antler described earlier (fig. 57).

COPPER

A thin piece of copper was found which measured 13 × 20 mm.; from historic horizon.

HOUSEHOLD UTENSILS

Awl Tip. Broken, 39 mm. long, 13 × 5 mm. at broken end; tip is convex, 3 mm. wide by 0.9 mm. thick, ovoid body section with one flattened side; steatite.

OCHRE

(Fig. 55)

Raw Material. Weight in grams (crushed) 2985.

Prepared. Weight in grams. 0.1.

Ochre nether grinding stone. Flat rocks used as nether stone in the preparation of ochre.

Ochre hand grinding stone. Various pounding and grinding stones used to crush ochre.

Palette? Flat piece of talus. Flat, rectangular, one side concave, other slightly convex; both sides polished. Size: 115 × 82.16 mm. Microscopic examination re-

veals a small amount of ochre (homogeneous and dark in color) on the concave face. The depressions on the convex face have minute particles of ochre which are brighter in color and more granular than that on the other side.

MISCELLANEOUS BIFACIALLY FLAKED TOOLS

Type A Blades, Triangular. Triangular knives, small flat bifacially flaked cutting tools triangular to rectangular in outline.

Knives, Biface. Miscellaneous flakes having a straight, bifacially flaked cutting edge.

MISCELLANEOUS CHIPPED STONE

Pebbles, Chipped. Small, flat, ovoid water-worn pebbles with a flake struck off the edge.

Flakes, Unmodified. Miscellaneous chert, probably waste flakes, from lowest levels (fig. 53*b*, A). These formed a cache.

MISCELLANEOUS POUNDING STONES

Converted Tools: Hammer-Mano. Former manos, choppers and sidepolishers, converted to use as hammerstones.

Maul, Grooved. Half groove at center.

Maul, Plain. Water-worn cobbles, naturally shaped like a pestle, oblong with an expanded end.

MISCELLANEOUS

Wood. Pieces of wood. Some appear to have been small branches, other larger pieces are so deteriorated it is impossible to tell whether they were worked. One or two may have been pieces of firewood.

Vesicular Basalt. Carbon encrusted stones; may have been used for lining fire-pits.

SHAPED STONE, MISCELLANEOUS

Carved Steatite (1). Flat, grooved piece of steatite, 25 × 8.2 mm.

Drill Rest (2). Fragment of a flat oval stone with circular depressions ground into both sides; depressions directly opposed. Broken in half.

Flaker? (3). Small fragment 43 × 18.12 mm.; broken at large end, tapers to a bluntly rounded, polished tip (igneous rock).

Flaker? (4). Broken; 25 × 18 mm. at large end, tapering to (highly polished) rounded blunt point; sides are flat, polished, and one has longitudinal scratches; edges rounded by pecking, and taper from 25 mm. to approximately 13 mm. near tip.

Wedge (5). Broken; length 51 mm. diameter, 13 × 28 mm. at broken end tapers to 3 × 9 mm. straight tip with rounded sides; body polyhedral; one edge worn smooth and flat; polished; andesite.

Amulet (*cf.* fig. 57, top row right). Small curved water-worn stone with longitudinal groove.

Specimens 3, 4, and 5 above have been used for polishing and 3 and 4 might have been used also as flakers. Mr. Thomas Newman suggests that specimens 3 and 4 (fig. 51*c*, E–F) resemble pointed stone objects found in the Plains and thought to have been used for whetstones for bone points and needles, etc. The flat surfaces on these would hardly seem to lend themselves to that function.

COMBINATION TOOL

Graver-drill. Drill, type D-5 with a graving bit; type G-4 on the drill base.

Graver-scraper. Graving tip and scraping edge on same tool.

Chopper-scraper. Chert cores or large flakes, percussion flaking, minor retouching (probably from use), steep keel on cortical side.

VI. THE CULTURAL RECORD

The total number of artifacts from sites WS-4 and WS-1 was approximately 20,000; of these some 13,000 came from WS-4 and 7,000 from the other site. The Roadcut produced 8,820, Pit 1, 1,303, Pit 2, 1,419, Pit 3, 99 plus 504 as grave goods, Pit 4, 161, Pit 5, 564, Pit 6, 60. WS-1 in 1952 and 1953 produced 1,854 and the balance of approximately 5,000 in 1956. The vast majority of these artifacts were stone. The balance was bone and antler from the earlier levels in the Roadcut and one piece of basketry from the later fill. This was Catlow twine with false embroidery, found in the fill of old channel "B" (map 7) in a fire lens exposed by the "shoofly" excavation.

Observation of the artifact inventory during the different excavations made it clear that we were dealing with cultural manifestations that were related both temporally and spatially, so it was essential to handle the material as a single unit of analysis. The Roadcut site provided a long unbroken sequence of occupation from very early times to what appeared to be the beginning of essentially the recent pattern of the Columbia River stone industry for the area. The pits from 1953 clearly fitted into the later part of the cultural column from the Roadcut and the same was true for WS-1. It was clear, also, that there were pronounced changes in the artifact inventory through the period of the area. The problem was to set up a base column or developmental sequence and then fit the curves of the other areas to this. With this in mind, we arranged for C-14 testing samples from critical points in the Roadcut, and selected another from the deepest of our pits, Pit 2, with the idea that the last specimen would give us a cross date, an overlapping, for comparison with the Roadcut control. Further, it was quite clear from the artifacts that the earliest part of Pit 2 was related to the cultural development of the upper part of the Roadcut. Unfortunately, the Roadcut sequence was truncated by the removal of some seven to eight feet of fill at the time of the building of the original

Columbia River highway. While this is unfortunate, it is not disastrous as our record shows.

The method we have used to present our material is to use the Roadcut record as our main frame of reference. When we compare the artifacts from the pit area in order to secure a larger, and we believe, a more representative sample, we combined all the artifacts from the three main pits into a single series. To do this however it was necessary to combine them not by arbitrary levels but by levels which matched typologically. We experimented with various graphic devices to illustrate the percentage record and finally settled on a three-unit-moving average to smooth out the sharp variations in the curves. We experimented with a variety of artifact types for the purpose of determining for the late period, that of the last of the Roadcut and the pits, the internal relationships of the various parts of the site and the sites. Probably owing to the errors of sampling arising from small areas excavated in the pits and the likelihood that the area was not all used at the same time, the use of single artifact types was of little help.

We, therefore, decided to try a combination of types and settled on a series which, it seemed to us, would be representative of the main activities of the occupants. We chose points, blades and blade fragments, end scrapers, and peripherally flaked cobbles. These four categories were then grouped by levels and the percentage they comprised of the total artifact inventory for the corresponding level was calculated. This calculation provided the basis for our comparison of the relation of pit to pit and to the first nine levels of excavation of the Roadcut. The results are shown in figure 23. The analysis was made for each pit, the curves drawn and an effort was made to establish a fit. This method is obviously based upon visual inspection by which corresponding configurations are observed and then adjusted or fitted. We do not claim this method is foolproof but it is a workable device and it seems to have worked well. Some artifact categories, especially those which are not representative of wide use, will show considerable fluctuation depending on the chances of sampling if one relies on a small excavation. This is well shown in figure 22 by using four separate categories for three pits.

In the immediate top of the fill of the Roadcut were a few articles of white manufacture. These are easily accounted for because this area was used as a construction site during the building of The Dalles-Celilo Canal and the Columbia highway was built over the site. They can therefore be disregarded as intrusive (fig. 61*b*).

CULTURAL STAGES

The artifacts from our sites fall nicely into three main stages, which may be designated Early, Transitional, and Late. These can be further divided as follows:

Late
Contact-Historic
Full Protohistoric
Initial Protohistoric

Transitional

Early
Final
Fully Developed
Initial

There are certain categories of artifacts which start in the Early and continue throughout the whole period of occupation. Others make up a complex limited to the Early period. The Transitional period is characterized mostly by those artifacts found in the Early and then extending through the Transitional and throughout the Late. The Late period is marked by the addition of new types of artifacts and increase in number. This sequence is meant, of course, to be applied only to the area of The Dalles.

Figure 21 shows this developmental sequence where it is superimposed on the geological stratigraphy with C-14 referents. The Early period starts with Level 39 and terminates with the beginning of Level 20. These points as demarcating the division between periods must of course be taken as indicating a boundary. It is the total assemblage which gives each period its character. Any limit under these circumstances is purely arbitrary but an inspection of the distributions of the data makes possible a workable decision in each case.

Initial Early is characterized by a limited artifact inventory both in numbers and kinds. Blades, scrapers, and a few bone specimens comprise the series. Some bone materials begin to appear in the upper levels with the specimen we have tentatively identified as the prong of a harpoon (figs. 20A; 40*a*, *b*, F), coming from Level 37. This stage we start at Level 37, the bottom of the excavation, and continue through Level 33.

Full Early is characterized by the rich bone and antler industry, burins, bolas, blades, enormous numbers of salmon vertebrae, bird bones, animal bones, red ochre in all stages of preparation from the raw material up to the finished powder, and projectile points of Type I, most of which are the non-stemmed variety, or having a constricted, tapering stem like the 11-A type reported for Kawumkan Springs on the Klamath Indian reservation (Cressman, 1956). This stage takes in Levels 32 through 25. It starts in the upper part of our geological Stratum I, characterized by sedimentation although on a somewhat lesser scale than earlier, and continues through Stratum II.

Final Early marks the gradual decline and complete disappearance of the bone and antler industry, the disappearance of the bird, animal, and fish bones, burins, and bolas though a few artifacts have been identified as belonging in these latter two categories from upper

levels. However, our identification may be incorrect or they may be casual specimens, or specimens picked up by the later occupants and carried in. At any rate, the association which marks this series of artifacts and the bone and antler materials no longer exists. This stage includes that part of the fill from Level 24 through 20 and includes our geological Stratum III and the lower part of IV.

Transitional includes some few points and the non-diagnostic materials such as non-distinctive choppers, scrapers, etc. Distinctive Early materials drop out early in the Transitional. The peripherally flaked cobbles show a rise in incidence and probably indicate a functional replacement of blades, characteristic of the Early stage. It is a stage with little character beyond that of any aboriginal camping area, and in excavating one had the impression that this was a period of light occupancy as compared with the Full Early. This stage extends from 19 through 11 or most of the hardpan, Stratum IV. It is bracketed between the C-14 date 6090 ± 80 and a date somewhat subsequent to 7875 ± 100.

Late. This period extends from Level 10 with a C-14 date of 6090 ± 80 to contact time. *Initial Protohistoric* is characterized by an increased use of the site with the construction of clearly recognizable fire pits although they are not walled in any manner. Types II and III points appear.

Full Protohistoric is characterized by the great variety in projectile point types, carved stone, some carved bone, pipes, ornaments, etc.

Contact-Historic has added to the preceding inventory the introduction of metal, copper and iron, both in the form of prestige items and tools and weapons.

The shifting character of the cultural inventory in the Roadcut and for our area can best be shown by grouping the artifact categories according to their stages of incidence: those which are limited for all practical purposes to the Early stage, those which occur in the Early and extend in *decreasing* numbers to succeeding periods, those which occur in the Early but extend in *increasing* numbers to successive stages and those which are limited to the Late phase of occupation (fig. 28).

Early Only. All antler and bone artifacts are essentially Early. There are nine out of eighty-eight antler artifacts found in the lower part of the Transition zone and seven bone artifacts occur in the bottom of the Transitional while thirty-six are Early. There are forty-six burins of which five are "burin-like." Thirty-three of these are Early and six are in the beginning of the Transitional. The association of the thirty-nine with the antler and bone artifacts gives a supporting functional association to support our classification on purely formal grounds. It is possible that the specimens from the Late stage, four burins and three "burin-like," may have the formal attributes simply as a result of breakage; there is no association with any bone or antler, worked or unworked. Another situation suggesting that these Late specimens are not functional burins in the sense of the Early ones is that none occurs between these Late specimens and those from the beginning of the Transitional.

Girdled bolas follow the distribution of the bone and antler artifacts as well as the bird bones (fig. 21). The unmodified bola, that is ungirdled, provides twenty-six specimens in the Early and eight in the beginning of the Transitional. However, ten are listed from the Late. These ten are scattered specimens and had it not been for the association of the others with the bird bones and the girdled bolas they would not have been identified as such. It is more likely that they may be sling stones or simply stones carried into the site by some of the occupants. These unmodified bolas could have been fastened to a thong by being tied in a leather pouch (Gonzales, 1953).

Early then Decreasing. A series of types falls in this major group: those which have their heaviest incidence in the Early stage then progressively decrease in number, some going through the Transitional only while others extend into the Late. There are seven plumb-bobs in the Early, two in the Transitional, and one in the Initial Late (Level 6). If all the specimens we have called "unmodified bolas" are really bolas then they too belong here. It is possible that the single plumb bob might have been picked up along the river and carried in from an earlier deposit by an occupant for these specimens have been seen in collector's materials from the area. Blade A series have 84 per cent in the Early and 7 per cent in the Transitional, with one specimen each of Types A-4 and A-15 in the Late and A-1 has one specimen in the Transitional and three in the Late. Blade B has 78 per cent in the Early, 11 per cent in the Transitional and the same in the Late. Biface choppers have 82 per cent in the Early, 11 per cent in the Transitional, and one specimen in the Late. Side polishers show 72 per cent in the Early, 19 per cent in the Transitional, and 9 per cent in the Initial Late. Thirteen polishing stones are distributed with nine in the Early, three Transitional, and one Late. Four miscellaneous unifacially flaked tools have three in the Early and one Transitional. Unifacial flaking is generally Early. Ochre grinding stones are distributed as follows: twenty specimens in the Early, seventeen in the Transitional, and ten in the Late stage.

Early then Increasing. Gravers-scrapers start in the Early but continue with 62 per cent in the Late. Punches show two in the Early, two in the Transitional and fourteen in Late. Gravers of which there are 275 are distributed with 8 per cent in the Early, the same in the Transitional, and 83 per cent in the Late. Scrapers, with the exception noted below, occur throughout with 21 per cent in the Early, 15 per cent in the Transitional, and 64 per cent in the Late period. Twenty-five snub-nose scrapers occur throughout with 60 per cent in the Late. Seventeen Class ES End Scrapers occur from

TYPE	I		II		III		IV		V		VI	
LEVEL	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
1	5	10	40	48	8	47	2	67	6	67	4	67
2	9	19	14	17	4	24	1	33	2	22	1	11
3	1	2	7	8	1	6			1	11		
4	5	10	9	11	3	18						
5	3	6	11	13	0	0						
6	3	6	2	2	1	6						
7	9	19										
8	7	15										
9	2	4										
10	4	8										
11	0	0										

CHART 1. Projectile Point types by number and per cent, Levels 1–11, WS-4, Roadcut; 20 cm. levels.

TYPE	I		II		III		IV		V		VI	
LEVEL	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
1	12	5.5	17	4.1	11	5.8			3	6.7		
2	29	13	40	9.6	15	8	1	9.1	6	13	2	17
3	37	17	67	16	29	15	4	36	5	11	1	8.3
4	25	11	84	20	52	28	2	18	7	16	3	25
5	61	27	87	21	50	27	3	27	11	25	4	33
6	32	14	99	24	23	12	1	9	10	22	2	17
7	15	6.7	21	5	8	4			3	6.7		
8	2	0.9	1	0.2								
TOTAL	224		416		188		11		45		12	

CHART 2. Projectile point types by number and per cent by 50 cm. levels, WS-1, 1956.

the Early on with 65 per cent in the Late. Planes occur from the Initial Early throughout without any marked variation. Class C choppers are found throughout with the most in the Late.

Late Only. Projectile points (charts 1 and 2), with the exception of Type I which occurs throughout and some two or three specimens from the Early which have been put in the Type II category and treated as erratics in their location, are all Late. Types II and III start in the Initial Late and increase in numbers in succeeding levels. These are the two most common types throughout a wide area. Types IV, V, and VI appear first in Level 2 although one specimen of V was found in Level 3. These last three types, all from our Full Protohistoric represent those specialized types characteristic of this area of the Columbia River and may be taken as marking the inception of the exuberant stone-working style. In the Late only, Full Protohistoric, are found charm stones, carved steatite beads and pendants, the latter flat and girdled, and the former tubular. Round flat beads of both steatite and other stone occur. Pipes also come from the Late. One specimen of a half-grooved maul comes from the Late. The nipple-ended type of decorated maul comes from the Full Protohistoric. Carved pestles are found in the Full Protohistoric. Fourteen specimens of the hammer-anvil are limited to the Late period. Of the peripherally flaked cobbles, Types CC-1 and CC-2 are limited to the Late period, whereas the others are found both in the Early and Transitional, with the heavier incidence in the former. The concave type of scraper (seven specimens) occurs only in the Late stage. Fifty-three drills are limited to the Late period but one, Class D-5, comes from the Full Early. One graver-punch comes from the Late. Notched sinkers are limited to the Late period. To the Full Protohistoric and probably the latter part of this period should be assigned the wide range of stone sculpture so distinctive of the region. The bone carving is also a product of the same period. One piece of Catlow twine basketry with false embroidery is to be assigned to the Late period, probably the Initial Protohistoric.

Contact-Historic. This stage has in addition to the inventory of the Full Protohistoric the use of trade materials, especially copper in the form of beads shaped like dentalium, iron occurring in the form of knives, firearms, hatchets, fishhooks, strike-a-lights, gun flints, etc. Burial by inhumation was practiced, at least in our area until sometime after 1820 as shown by the grave goods (*cf.* Appendix B) and this was followed by cremation.

Some artifacts like hammerstones are of no diagnostic value for they are general utility tools that are a necessary part of any stone-working technology. They occur throughout the deposit with little variation in incidence.

Figure 28 shows graphically the major categories of artifacts we have just discussed.

Techniques of Stone Working. During the first part of the Early period of occupation percussion flaking, often without retouch, was in use and both core and flake instruments were produced. The first retouching seems to have been done by percussion. Wide shallow flake scars probably indicate the use of the antler cylinders as flaking tools, the cylinder hammer technique of the paleolithic knappers. Pressure flaking appears before the Transitional and the ends of the antler tines are to be associated with it. It is possible that some of the early percussion flaking was done with flat river pebbles as some of these appear in the fill and show edge scars which may reasonably be attributed to this kind of use. The percussion flaking of the Early period, often applied to refractory materials such as quartzite, shows a fine mastery of the method. Some specimens exhibit very rough workmanship but others show that when desired the skill was not only available but applied (*cf.* fig. 42). In the Late period the superb projectile points probably have no equal as a series in the New World both in the variety of forms and the skill in their manufacture. One carnelian arrow point secured in the 1938 excavations at WS-1 is only 3 mm. in maximum thickness. It is 27 mm. from tip to the base of the stem which is 5 mm. wide and measures 23 mm. point to point of the barbs. The final retouching flake scars on this elegant piece are mostly not more than 1 mm. in width. (It is difficult to represent these projectile points adequately by black and white photography because some specimens are translucent, others so in part and others opaque.) The sculptured stone objects from the Full Protohistoric show not only a highly developed artistic sense but again the mastery of the skills of carving and polishing to execute the artists' objective (*cf.* fig. 60).

Grinding tools occur throughout the deposit but pestles and mortars appear only in the Late period. The side polisher seems to be known only from the Columbia River area and disappears before the Late period. Mortars and pestles were frequently the decorative field for carving of both human and animal forms. Since the mano-metate complex does not lend itself to this function, we have perhaps an explanation of the importance of the mortar-pestle complex in the Late period. The abrading and polishing techniques were highly developed with the manipulation of bone and antler in the Early period and from this field were probably transferred to the medium of stone as was the case in the Paleolithic of Europe. The skills of abrading, carving, and polishing were extended in the Late period from stone to both wood and mountain sheep horn (*cf.* fig. 59). Not only was there a wide variety of stone sculpture on movable objects but the same skill and interests were applied to the production of petroglyphs, particularly on the Washington side of the river. The technological development in stone work thus runs the whole range from percussion flaking through percussion retouch, pressure flaking, abrading, carving, and polishing, and from the production of strictly utilitarian tools and weapons to a wide variety of objects that can only be accounted for as an expression of a drive to achieve virtuosity in this medium as some groups did in basketry and others in wood carving.

FEATURES

Features are those evidences of human activity such as fireplaces, occupation areas, etc., which cannot be removed like other artifacts to the laboratory for study. Most of the features in our excavations represent some distinctive evidence of activities associated with work or living areas. One at WS-1 may be a rude housepit but this identification is pure conjecture. Clusters of tools, finished and unfinished, associated often with animal bones and charcoal seem to be most characteristic. In some cases a cache of tools occurred. Immediately above the hardpan level in our Initial Late stage occurred a series of shallow pits which were lined with some unidentifiable material which had the appearance of bleached reeds. They did not appear to be woven in any way. The same material appeared as scattered fragments in Pit 2 and in the WS-1 1953 excavations. The same materials were observed at the Wakemap Mound during a visit in 1953 but there they appeared to follow the slopes of earlier surfaces. One of these pits was certainly an empty storage pit, lined with what appeared to be large pieces of bark, badly decomposed and bleached white. These shallow pits appeared suddenly and together with fireplaces of fire-broken rock and charcoal indicated the introduction of new activity and a stepped-up level of use of the site after a fairly stabilized period of light use through the Transitional.

Two outstanding Features—12 and a group, 25, 28, 29, which probably form a single Feature—will be described.

Feature 12. This was an occupation level the boundaries of which could not be determined because they extended under unexcavated areas. It is located in Level 28 in the Full Early and extends parallel to the face of the excavation for about five meters, from 5.5X to 10.25X. Large flat blocks of basalt extend throughout the area, almost like a pavement. It is suggested that these formed a platform and were covered by mats or reeds or some similar material to provide a dry, firm living surface. The fill at this period would have been quite wet especially at times of high water. One is reminded of the platform of branches, clay and other materials in the Star Carr site (Clark, 1954: 9). Stains of charcoal occur through the deposit and adhere to some of the pieces of basalt. Thirty artifacts and

130 bird bones were scattered through the debris. The artifact inventory is as follows:

Spall scraper	1
Hammerstone fragment	2
Hammerstone	8
Burin type 2	1
Points type 1	3
Metate	2
Mano	2
Flake scraper	1
Anvil	1
Chipped pebbles	5
Biface fragments type 2	1
Blade B-8	1
Chopper C-2	1
Problematical stone	1

Bird bones 130; minimum number of individuals

Cormorant	2
Condor	2
Eagle	3
Gull	3
Raven	1

Features 25, 28, and 29 represent continuous living areas occupying two levels of fill (40 cm.). Feature 25, Level 30, contained forty-four stone artifacts, three bone and antler, 40.6 grams of prepared ochre, bones of two eagles (skulls and others) and one condor, and one cervid, seven beaver, and one phocid bone. In addition four pieces of wood were included.

Feature 28 (Level 30) contained forty stone artifacts including both a girdled and an unmodified bola, 235.4 grams of prepared ochre, three bone and antler artifacts, one piece of wood, and forty-eight bird bones comprising an assemblage of cormorant, condor, eagle, and gull. Salmon bones are not included in any of the counts of the contents of features.

Feature 29 (Level 31, fig. 54) contained fifteen artifacts, two of which were antler, in addition to a cache. The cache was a small basin depression about the size and shape of a small wash basin and was covered by a large slab of basalt. The cache contained one side scraper, five flake scrapers of obsidian, one polyhedral core, one Type 1 burin, one knife, one B-2 blade, one crude end scraper, one awl, and the mandible of an otter. The obsidian flakes in this cache are of particular significance for the nearest obsidian is probably to be found in the Bend area some 150 miles to the south. Obsidian does not occur otherwise in the site until quite late and then only as the material for a few arrow points. Quite often the obsidian used then is the clear variety as though the effort was made to get a material that at least looked like the chalcedonies and other cryptocrystalline rocks which had provided the raw material for points for many centuries.

The distribution of the projectile points at WS-1 (chart 2) and the same kind of comparison of the four categories as a percentage of all the artifacts in that level as used at WS-4 indicates that the occupation of WS-1 did not precede significantly, that is with any intensity, the beginning of the Full Protohistoric of the Late period as set up for the Roadcut site. This approximates the time of the occupation at the end of our excavation in Pit 2 and corresponds to Level 4 in the Roadcut. There may have been some occupation approximating the beginning of the Late period but the Full Protohistoric character of the culture is clear.

Summary. Because we had long sequence of stratigraphically controlled and dated points by C-14 determination on the Roadcut site, we used that to lay out a cultural column which could be used to determine the dynamics of the cultural development at that point and to which the other parts of our excavations, the pits of 1953 and WS-1, could be referred for cross dating. The artifact sequences indicated a three-stage period of development which we called Early, Transitional, and Late and divided the first and the last into three substages respectively. The basis of the division was the existence of groups of artifacts and ways of life showing distinct differences. One group was limited to the early part of the occupation. Some categories of the Early continued in either a decreasing or increasing incidence through the following period of use. There then occurred a new cultural impetus with the introduction of new artifacts added to those manifestations which had carried on through from the earlier periods together with apparently a heavier incidence of occupation. These new artifact categories enabled us to set up the Late period. The pits from the 1953 excavations and WS-1 recorded an occupation which belonged to the Late period.

VII. GENERAL DISCUSSION

The archaeological area of Fivemile Rapids has provided a unique cultural record for the western part of North America. Most of the sites of Early Man represent big game hunting localities where animals have been killed in bogs or perhaps quicksand, or at any rate situations in which their movement was hindered and they could be effectively attacked by hunters. Other

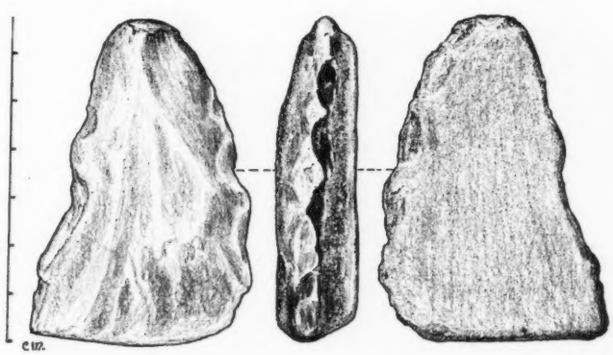


FIG. 27. Knife from gravels of Spokane Flood; mouth of John Day River.

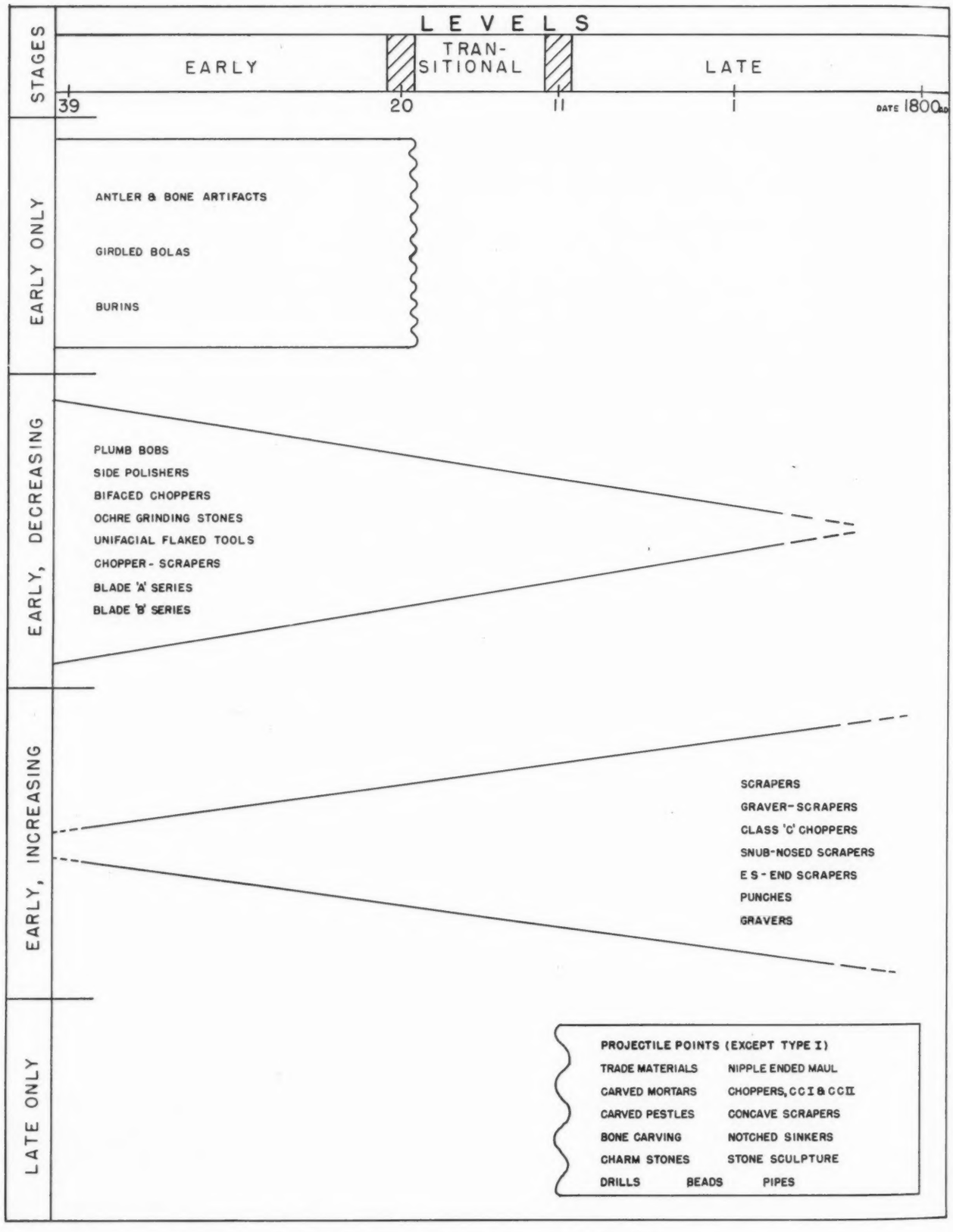


FIG. 28. Cultural-historical sequences at The Dalles.

sites are cave habitations. Danger Cave (Jennings, 1957) provides the longest record of continuous occupation of the latter kind of site. Sporadic manifestations of short time campsites have been widely reported. The distribution of the Early Man sites in the West shows that most of them were in that part of the interior Basin and Range province subject to the great variations of climate in the post-Pleistocene. This condition generally made impossible continuous occupation. The exception, Danger Cave, has been noted.

The possibility of continuous occupation from the end of the Pleistocene to historic times required a certain stabilization of ecological conditions or a modification of culture by which small groups could continue to exploit the less favorable resources brought about by a climatic change which reduced the environmental opportunities. The Klamath Lake area in south-central Oregon, studied and reported on by Cressman and his students (Cressman, 1956), provided a region of unfailing water and stable environment. Here the occupation was continuous from the end of the Pleistocene to historic times, not in one site but in a series of adjacent sites whose occupation overlapped in time. Here the culture changed from the early Great Basin type to one which exploited the resources of the rivers and the marshes. The Columbia River, draining the area north of the Great Basin, provided a possible habitat and refuge area for those population elements forced to move from the south by the desiccation of their area in the Altithermal. There was also, of course, the possibility of an early occupation of the Columbia area from other sources than the Great Basin. Daugherty (1956) provided the first factual evidence of early occupation of the Columbia Plateau by big game hunters, a people who did not use the river but roamed the country to the south and east in the hunt for bison. The Fivemile Rapids site, because of the exploitation of a riverine resource, is most closely related to the Klamath Lake area in terms of long and continuous occupation and basic subsistence patterns.

This, then, was the situation with regard to the Columbia River when excavation was started at Fivemile Rapids in 1952. The theoretical framework of the problem had been formulated but the outcome of the research was far more impressive than we had even dared hope. Here was an area of occupation by people who had based their subsistence patterns upon the wealth of the river, who had begun that way of life at the end of the Pleistocene and continued it with variation down to the coming of the white man. Probably their predecessors, those before the Spokane Flood, were hunters, and ours represent the river exploiters for they do not seem to have been to any extent big game hunters. Yet the cultural record is incomplete and leaves us with many questions unanswered both as to the way of life and the comings and goings of populations. The temporal, ecological, and socio-economic aspects of the record will be discussed briefly in that order.

TEMPORAL ASPECTS

In evaluating the temporal aspects of the occupation of this area, attention must be called to certain contributory information, the first from the John Day River about twenty-five miles to the east and the other from the Washington side of the river at the west end of Big Eddy, the western terminus of the rapids. At the John Day River, on the west side, some hundreds of feet above the present river, the writer, in the autumn of 1953, found cemented in the gravels of an old bar, used as a borrow pit by the State Highway Department, a knife made from a basalt slab (fig. 27). This gravel bar is a deposit of the Spokane Flood (Bretz, 1925) which has been attributed to various times in the Pleistocene but according to Sargent was most probably in the late Pleistocene. The flood was caused by the break in an ice dam which released an estimated 500 cubic miles of water to pile debris high above the present river (*cf. supra*, p. 12). This artifact was firmly cemented in the gravels and had to be dug out with a paleontologist's pick. The geological identity of the gravel bar was checked with Sargent. This knife showed a zig-zag sharpened edge, a lesser degree of patination on the flake scars than on the unflaked surfaces, and smoothing from having been rolled in the water. To get evaluations of other archaeologists to check my opinion that this was an artifact, I showed it at different times to Emil Haury, John Corbett, Frank H. H. Roberts, Jr., and all identified it as an artifact.[1] This artifact then is proof that human occupancy of the Oregon side of the Columbia River was already established at the time of the Spokane Flood.

The second source of information comes from the Washington side of the river in the excavation made for the navigation locks of The Dalles Dam. Here in sand, under a bed of cemented gravel, which he believes owes its origin to the Spokane Flood, Sargent found charcoal remains, badly broken fragments of the bones of some mammal, perhaps camel, and artifacts. The latter consist of a basalt slab chopper, a piece of a mano, one broken flake scraper retouched on one edge, a pink chalcedony flake retouched to form a U-shaped notch 5 mm. wide, 3 mm. deep, one flake from a chalcedony pebble, and a small object, made out of chalcedony, 3 cm. long with an expanding, rounded head 11 mm. wide. The shaft which is half the total length decreases

[1] Professor Desmond Clark kindly examined this tool along with two others in December, 1958. He was hesitant to accept it as an artifact but did not reject it. I was not able to talk to Professor Clark at the time he examined the specimens but submitted them to him by mail and received his opinion by letter from Albuquerque, New Mexico, under date of December 12, 1958. I am sure from my experience with the aboriginal use of basalt for artifacts in this area that the hesitancies of Professor Clark could have been resolved in conversation.

from 7 mm. in width to 5 mm. at the bit. While the specimen suggests a drill the bit is chisel-shaped with retouching scars running at right angles to the bit. The gravel overlying the sand in which these artifacts lay was so heavily cemented that a big bulldozer could not move it without first having it blasted. Sargent would attribute this material and the specimen from the John Day to the period before the Spokane Flood.

The Spokane Flood was earlier than the occupation represented by the debris from the Roadcut site. The site on the Washington shore is about the same level as the bottom of our excavation. The flood water was sufficiently high that it would have rushed through the channel in which the Roadcut site was located and either filled it with gravel or scoured it clean of debris depending on the conditions of flow. The conclusion to be drawn from this evidence is that the occupation represented by the earliest in the Roadcut site is not the first occupation of the country. The first occupation may have been that of sporadic hunting parties or these first settlers may have been reasonably permanent but the evidence within the area of the flood would have been destroyed by the tremendous rush of water.

Another piece of evidence comes from within the Roadcut site. Two choppers (figs. 26*a*, *b*) quite evidently were *old tools* that were resharpened and used again. The nearly round biface chopper (fig. 26*b*) has old scars with nearly the same degree of patination as shown on a small portion of the remaining original surface. The new scars of the flakes removed to resharpen the tool show no patination. The boundaries of the old flake scars also show smoothness, either from water or sand blasting; but this surface modification is absent from the edges of the later flake scars. The new flake scars are shown with heavier shading (fig. 26*b*). This specimen comes from Level 29. Professor Desmond Clark examined the specimen illustrated in figure 26*b* at the same time he had the basalt piece. His comments, dated December 12, 1958, follow:

> I think you are quite right in saying you see two stages of flaking on WS4R1 F-29. The earlier is certainly more abraded than the later and is also more heavily patinated. I should imagine the earlier stage belongs to the time when water was washing fine silt over the tool. The roughening of the flake scars of the later stage of flaking is unusual, but I suppose has something to do with the nature of the raw material (impure chert). This type of roughening one sometimes finds on stones which have been subject to heating in a fire before being flaked. This specimen looks like one of the Australian or Tasmanian coroid tools. The Tasmanians used their specimens for tree climbing. I do not think your specimen shows a true prepared striking platform. I think the preparation is accidental resulting from the bilateral flaking of biconical cores, i.e. typical Mousterian disc cores often show this.

Another chopper, a good "pebble chopper" from Level 30, shows the same history, old flake scars which are smoothed and heavily patinated (fig. 26*a*). The lack of any random flaking on the river cobble argues against the earlier flaking having been produced naturally. It is purposive and controlled. The recent flaking follows the pattern of the earlier and obliterates the old scars except along one edge. It comes from Level 30. Now both these specimens indicate an earlier occupation than that of the later users. It is doubtful that, had they been used by the earliest occupants of the Roadcut site and dropped somewhere along the river to be picked up by the later people, they could in the elapsed time have developed the patination and smoothness on the old worked surfaces which they now possess. Sand blasting could have produced the finish but the ecological evidence does not indicate the condition necessary for this at the time that would have been necessary for this hypothesis to be true. Their age in the deposit is of the order of 9,000 years and yet from then to now they have developed no evidence of weathering. The evidence strongly indicates that these two tools probably belong to the same period of time as that represented by those related to the Spokane Flood, and were exposed for a considerable period to either sand blasting or silt abrasion in running water.

The evidence then indicates that human occupation of the Columbia River in this central region had started at some unknown time before the end of the Pleistocene, the period represented by the earliest debris from the Roadcut site.

The C-14 dating gives us a series of reference points for dating the site occupation (Barendsen *et al.*, 1957). The greatest age 9,785 ± 220 is a composite calculated from a sample of charcoal collected from throughout Stratum I. Since this stratum was approximately 2.5 m. deep and very compact, probably a considerable length of time is indicated. It would probably not be far wide of the mark to suggest that the earliest occupation of the site started not less than 11,000 or more years ago. The character of the fill, clayey silt to silty clay, indicates that the deposits were laid down by the river in quiet backwater as it filled back into the channel as it does now in the same kinds of places in the basalt at the lower levels (*cf.* Appendix A). If we are correct in this date, then the occupation is contemporary with the terminal Pleistocene, if we accept the date of 11,500 years ago for the beginning of the retreat of the Mankato glaciation. While some geologists refuse to accept this date the mass of evidence seeming to support it indicates that, until some defect in the C-14 method is demonstrated, it can be accepted.

The age for the overlying Stratum II is 7,675 ± 100 and while this is less than that for the next stratigraphically younger sample the difference is not statistically significant. It is also possible that the sample was contaminated in some manner. Because of the heavier amount of occupation in this part of the fill the cultural debris built up faster than in the earlier and a given depth of fill would represent a shorter time

of deposition. The sample for this period was also a composite for the whole stratum.

Whatever the explanation for the apparent lack of progressive change in the C-14 dates, the overall picture is correct and supports the stratigraphic order. At Level 23 the age is 7,875 ± 100 and at Level 10 it is 6,090 ± 80. From Level 25 through Level 10 deposition other than cultural was mostly aerial and the sand in the fill indicates strong wind action. Two meters of fill remained of the Roadcut site but approximately two more had been removed in building the old Columbia River highway. The age 2,395 ± 80 from Levels 19–20 in Pit 2 does not fit on the curve for the Roadcut artifact series. However, Pit 2 extended another 60 cm. and we have fitted Level 23 of the pit to the Roadcut Level 4. Granted this is an approximation, nevertheless, on the basis of the cultural analysis and cross identification of curves of artifacts, it seems entirely reasonable. The final date is a relative one derived from the grave goods associated with one of the burials in Pit 3, a Northwest Beaver Token bearing the date 1820. Therefore, the inhumation must be of that date or subsequent to it. Cremation followed the inhumation. If our cross-dating efforts are correct, it is reasonable to estimate the beginning of the Full Protohistoric at about 2,500 to 3,000 years ago with the full development considerably later, just how much we are reluctant to hazard a guess.

ECOLOGICAL ASPECTS

In the ecology of the immediate site area the most marked change from the Early period is the lowering of the level of the river and the change from a turbulent silt-laden stream carrying the outwash of the glaciers to its present character. At the end of the Pleistocene all the interior of British Columbia was covered with ice and as the glaciers retreated the Columbia carried a vast amount of gravel and silt (Davis and Mathews, 1944). The river reached its final level as the result of reduction of water supply with the melting of the glaciers and down cutting of its channel.

The river on March 17, 1957, was raised to the 155-foot level in The Dalles Dam reservoir. This was the level at times during the early occupation of the Roadcut site and figure 33 shows how the river would have backed up into the old channel and so it provides an actual representation of the earlier situation, infinitely more impressive than the image constructed by the imagination. The present situation of the river can be misleading unless one recalls that the present level is artificial, created by the dam. One needs to remember that, while the earlier level approximated the present, the river then was quite different. The great volume of water rushing over the drop in the basaltic exposures at the former rapids would have been a frightening and impressive sight. It would in all likelihood have been a barrier to movement of people except the most expert boatmen.

Changes have occurred in the vegetation cover but this is largely the result of human intervention. *Coragyps occidentalis* is extinct. Lewis and Clark reported the condor at the mouth of the Columbia in 1805 but not up river. Miller (1957: 61) writes,

> The only tarsi recovered from the midden are very definitely of the *californianus* type, so I am recording them as such, although it is freely admitted that there may have been a slightly different facies of condor inhabiting the Great Basin area during late Pleistocene or very early Recent time. Some of the Indian midden bones are larger than any in our limited series of Recent material but others are smaller. The Pleistocene material has a marked tendency toward larger size.

As one examines figure 21 he can hardly avoid drawing the conclusion that the marked change represented by the disappearance of the bones of the animals and artifacts made from antler and bone is the result of a marked ecological change. There is no substantial evidence for this conclusion except, perhaps, in the case of the condor and *Coragyps*. There was certainly some change in ecology as the sedimentation shows and how this may have affected the culture is discussed immediately below. All the other animals from our inventory were to be found in the area before being driven out or killed off by the whites.

There may be an aspect of the ecology as suggested above that gave rise to the cultural potential of the river in this area in particular. Mr. Thomas Newman has suggested that, as a result of the lower temperature of the water at the end of the Pleistocene and the large amount of silt carried by the river, there were few or no salmon in the river. They would have come in with the warming of the water and the reduction of the load of silt. The lack of salmon bones at the beginning would then be accounted for on natural grounds rather than by the hypothesis that the Indians lacked the technical equipment and knowledge to take them. Certainly the bones appear fairly suddenly and in very large numbers in an amazingly short time. We took out over 125,000 salmon vertebrae, mostly from Stratum II, and nearly as many more were removed by Mr. Cole in subsequent excavation for The Dalles Museum Commission. Newman's thesis cannot be proven or disproved but the evidence of a theoretical nature he has collected strongly suggests that he may be correct. It is interesting, as Newman has pointed out in first discussing this subject, that salmon bones appear at about the same time in the Kawumkan Midden of the Klamath Lake area (Cressman, 1956), a piece of information, which, with the Columbia record, gave Newman his idea. If Newman's theory is correct then we have an ecological change of a kind highly beneficial for the human use of the river.

Finally, we can say that even though there were effects of the climatic changes of the post-Pleistocene in this area the river was a stable factor, and probably the most significant changes that took place were the

from 7 mm. in width to 5 mm. at the bit. While the specimen suggests a drill the bit is chisel-shaped with retouching scars running at right angles to the bit. The gravel overlying the sand in which these artifacts lay was so heavily cemented that a big bulldozer could not move it without first having it blasted. Sargent would attribute this material and the specimen from the John Day to the period before the Spokane Flood.

The Spokane Flood was earlier than the occupation represented by the debris from the Roadcut site. The site on the Washington shore is about the same level as the bottom of our excavation. The flood water was sufficiently high that it would have rushed through the channel in which the Roadcut site was located and either filled it with gravel or scoured it clean of debris depending on the conditions of flow. The conclusion to be drawn from this evidence is that the occupation represented by the earliest in the Roadcut site is not the first occupation of the country. The first occupation may have been that of sporadic hunting parties or these first settlers may have been reasonably permanent but the evidence within the area of the flood would have been destroyed by the tremendous rush of water.

Another piece of evidence comes from within the Roadcut site. Two choppers (figs. 26*a, b*) quite evidently were *old tools* that were resharpened and used again. The nearly round biface chopper (fig. 26*b*) has old scars with nearly the same degree of patination as shown on a small portion of the remaining original surface. The new scars of the flakes removed to resharpen the tool show no patination. The boundaries of the old flake scars also show smoothness, either from water or sand blasting; but this surface modification is absent from the edges of the later flake scars. The new flake scars are shown with heavier shading (fig. 26*b*). This specimen comes from Level 29. Professor Desmond Clark examined the specimen illustrated in figure 26*b* at the same time he had the basalt piece. His comments, dated December 12, 1958, follow:

> I think you are quite right in saying you see two stages of flaking on WS4R1 F-29. The earlier is certainly more abraded than the later and is also more heavily patinated. I should imagine the earlier stage belongs to the time when water was washing fine silt over the tool. The roughening of the flake scars of the later stage of flaking is unusual, but I suppose has something to do with the nature of the raw material (impure chert). This type of roughening one sometimes finds on stones which have been subject to heating in a fire before being flaked. This specimen looks like one of the Australian or Tasmanian coroid tools. The Tasmanians used their specimens for tree climbing. I do not think your specimen shows a true prepared striking platform. I think the preparation is accidental resulting from the bilateral flaking of biconical cores, i.e. typical Mousterian disc cores often show this.

Another chopper, a good "pebble chopper" from Level 30, shows the same history, old flake scars which are smoothed and heavily patinated (fig. 26*a*). The lack of any random flaking on the river cobble argues against the earlier flaking having been produced naturally. It is purposive and controlled. The recent flaking follows the pattern of the earlier and obliterates the old scars except along one edge. It comes from Level 30. Now both these specimens indicate an earlier occupation than that of the later users. It is doubtful that, had they been used by the earliest occupants of the Roadcut site and dropped somewhere along the river to be picked up by the later people, they could in the elapsed time have developed the patination and smoothness on the old worked surfaces which they now possess. Sand blasting could have produced the finish but the ecological evidence does not indicate the condition necessary for this at the time that would have been necessary for this hypothesis to be true. Their age in the deposit is of the order of 9,000 years and yet from then to now they have developed no evidence of weathering. The evidence strongly indicates that these two tools probably belong to the same period of time as that represented by those related to the Spokane Flood, and were exposed for a considerable period to either sand blasting or silt abrasion in running water.

The evidence then indicates that human occupation of the Columbia River in this central region had started at some unknown time before the end of the Pleistocene, the period represented by the earliest debris from the Roadcut site.

The C-14 dating gives us a series of reference points for dating the site occupation (Barendsen *et al.*, 1957). The greatest age 9,785 ± 220 is a composite calculated from a sample of charcoal collected from throughout Stratum I. Since this stratum was approximately 2.5 m. deep and very compact, probably a considerable length of time is indicated. It would probably not be far wide of the mark to suggest that the earliest occupation of the site started not less than 11,000 or more years ago. The character of the fill, clayey silt to silty clay, indicates that the deposits were laid down by the river in quiet backwater as it filled back into the channel as it does now in the same kinds of places in the basalt at the lower levels (*cf.* Appendix A). If we are correct in this date, then the occupation is contemporary with the terminal Pleistocene, if we accept the date of 11,500 years ago for the beginning of the retreat of the Mankato glaciation. While some geologists refuse to accept this date the mass of evidence seeming to support it indicates that, until some defect in the C-14 method is demonstrated, it can be accepted.

The age for the overlying Stratum II is 7,675 ± 100 and while this is less than that for the next stratigraphically younger sample the difference is not statistically significant. It is also possible that the sample was contaminated in some manner. Because of the heavier amount of occupation in this part of the fill the cultural debris built up faster than in the earlier and a given depth of fill would represent a shorter time

of deposition. The sample for this period was also a composite for the whole stratum.

Whatever the explanation for the apparent lack of progressive change in the C-14 dates, the overall picture is correct and supports the stratigraphic order. At Level 23 the age is 7,875 ± 100 and at Level 10 it is 6,090 ± 80. From Level 25 through Level 10 deposition other than cultural was mostly aerial and the sand in the fill indicates strong wind action. Two meters of fill remained of the Roadcut site but approximately two more had been removed in building the old Columbia River highway. The age 2,395 ± 80 from Levels 19–20 in Pit 2 does not fit on the curve for the Roadcut artifact series. However, Pit 2 extended another 60 cm. and we have fitted Level 23 of the pit to the Roadcut Level 4. Granted this is an approximation, nevertheless, on the basis of the cultural analysis and cross identification of curves of artifacts, it seems entirely reasonable. The final date is a relative one derived from the grave goods associated with one of the burials in Pit 3, a Northwest Beaver Token bearing the date 1820. Therefore, the inhumation must be of that date or subsequent to it. Cremation followed the inhumation. If our cross-dating efforts are correct, it is reasonable to estimate the beginning of the Full Protohistoric at about 2,500 to 3,000 years ago with the full development considerably later, just how much we are reluctant to hazard a guess.

ECOLOGICAL ASPECTS

In the ecology of the immediate site area the most marked change from the Early period is the lowering of the level of the river and the change from a turbulent silt-laden stream carrying the outwash of the glaciers to its present character. At the end of the Pleistocene all the interior of British Columbia was covered with ice and as the glaciers retreated the Columbia carried a vast amount of gravel and silt (Davis and Mathews, 1944). The river reached its final level as the result of reduction of water supply with the melting of the glaciers and down cutting of its channel.

The river on March 17, 1957, was raised to the 155-foot level in The Dalles Dam reservoir. This was the level at times during the early occupation of the Roadcut site and figure 33 shows how the river would have backed up into the old channel and so it provides an actual representation of the earlier situation, infinitely more impressive than the image constructed by the imagination. The present situation of the river can be misleading unless one recalls that the present level is artificial, created by the dam. One needs to remember that, while the earlier level approximated the present, the river then was quite different. The great volume of water rushing over the drop in the basaltic exposures at the former rapids would have been a frightening and impressive sight. It would in all likelihood have been a barrier to movement of people except the most expert boatmen.

Changes have occurred in the vegetation cover but this is largely the result of human intervention. *Coragyps occidentalis* is extinct. Lewis and Clark reported the condor at the mouth of the Columbia in 1805 but not up river. Miller (1957: 61) writes,

> The only tarsi recovered from the midden are very definitely of the *californianus* type, so I am recording them as such, although it is freely admitted that there may have been a slightly different facies of condor inhabiting the Great Basin area during late Pleistocene or very early Recent time. Some of the Indian midden bones are larger than any in our limited series of Recent material but others are smaller. The Pleistocene material has a marked tendency toward larger size.

As one examines figure 21 he can hardly avoid drawing the conclusion that the marked change represented by the disappearance of the bones of the animals and artifacts made from antler and bone is the result of a marked ecological change. There is no substantial evidence for this conclusion except, perhaps, in the case of the condor and *Coragyps*. There was certainly some change in ecology as the sedimentation shows and how this may have affected the culture is discussed immediately below. All the other animals from our inventory were to be found in the area before being driven out or killed off by the whites.

There may be an aspect of the ecology as suggested above that gave rise to the cultural potential of the river in this area in particular. Mr. Thomas Newman has suggested that, as a result of the lower temperature of the water at the end of the Pleistocene and the large amount of silt carried by the river, there were few or no salmon in the river. They would have come in with the warming of the water and the reduction of the load of silt. The lack of salmon bones at the beginning would then be accounted for on natural grounds rather than by the hypothesis that the Indians lacked the technical equipment and knowledge to take them. Certainly the bones appear fairly suddenly and in very large numbers in an amazingly short time. We took out over 125,000 salmon vertebrae, mostly from Stratum II, and nearly as many more were removed by Mr. Cole in subsequent excavation for The Dalles Museum Commission. Newman's thesis cannot be proven or disproved but the evidence of a theoretical nature he has collected strongly suggests that he may be correct. It is interesting, as Newman has pointed out in first discussing this subject, that salmon bones appear at about the same time in the Kawumkan Midden of the Klamath Lake area (Cressman, 1956), a piece of information, which, with the Columbia record, gave Newman his idea. If Newman's theory is correct then we have an ecological change of a kind highly beneficial for the human use of the river.

Finally, we can say that even though there were effects of the climatic changes of the post-Pleistocene in this area the river was a stable factor, and probably the most significant changes that took place were the

extinction of certain types of great birds, the lowering of the river level with reduction in volume and, perhaps, the coming of the salmon. The lowering of the river level would have greatly reduced the importance of the river as a barrier to migrant peoples whereas in the earlier condition it would have had the tendency to shunt them northward along the eastern side toward interior British Columbia.

CULTURAL CHANGES

We have earlier discussed the artifact types and the changes which occur throughout the occupation. We shall consider some of the broader implications at this time. The Early period quite clearly represents an adaptation to the ecological resources of the region. Salmon were soon taken in great numbers; small animals were part of the food supply but the larger animals were not very much in evidence. The antlers were certainly in some cases those that were shed while others were cut and broken from the skulls of killed animals. The most impressive characteristic of the faunal remains is the great number of large birds represented in the site in a relatively short period of time. The association of bolas, bones of large birds, bone and antler artifacts comprising a range from harpoons through pounding tools, those used for smoothing and softening skins, to ordinary flakers and others of a completely unknown use, and fish indicate conclusively a way of life oriented on the river and the land resources immediately adjacent to it. The birds in the inventory—only one duck and nine geese are included—are mostly scavengers with a strong liking for fish. Some of the larger ones generally have to run a short distance before getting into the air and would thus be at this time a fine target for the bola thrower. Gulls crowd up around food and they too would make a good target. The question is open whether these birds were used for food, for a supply of feathers and skins, or for both. Bird skins were sometimes used for blankets, according to folklore (Spier and Sapir, 1931; in the tale, "The Deserted Boy," the boy has a magpie blanket). The presence of large amounts of prepared ochre, along with the tools for preparing it and the different stages of preparation which we found, suggests that there was some important ceremonial complex with which that material, the birds, and probably some of the antler artifacts were associated. Figure 21 shows the development and disappearance of this association.

Bolas have been recorded for early horizons in New Mexico (Hibben, 1941; Wormington, 1957), but they have apparently been used for hunting large land animals. They were so used in the Paleolithic of East Africa. In the New World they were used by Eskimos taking birds, but bone or ivory rather than stone was used. Our record is the only one so far known in the New World where they were used for taking birds at this early period.

These people in the Early period were expert in flaking stone both by percussion and later by pressure, too. Lamellar flakes occur both unretouched and retouched into blades. Both core and flake tools occur at the same period. Striking platforms sometimes are left without retouching and at other times the worker carefully trimmed that area. The river gravels provided a great wealth of material for stone tools and many varieties of rock were used. Quartzite is used with considerable frequency and this is a very difficult material to flake. One is impressed by the great numbers of river cobbles often as large as the hand and perhaps an inch and a half thick which were broken in two and the broken end roughly flaked by percussion into a chopping tool. Flat basalt slabs were frequently sharpened along one edge by percussion and used for choppers.

Burins of several kinds were used to prepare the antler and bone in the early stages of cutting out slabs. It was fortunate that antler stock and pieces in different stages of preparation were found for it enabled us to determine the manner in which this material was prepared. It is true that flakes could be used without the necessity of having the prepared burin but the prepared burin was in use here. A small number of burins has been reported from the Wakemap mound on the opposite shore from our site, which falls in our Full Protohistoric, and we have reported four, and three "burin-like" tools from our Late period. However, there are none in the intervening fill representing several thousand years. The ones from the Late period may be associated with the bone-carving activity which developed and they may be more of the nature of gravers than true functional burins.

The Early period is thus characterized by a way of life oriented on the river and shows a wide range of skills in the use and manipulation of stone, bone, and antler. There is the further suggestion of a ceremonial complex associated with some aspect of the culture, possibly the use of birds. A wide range of flaked stone tools with both flake and core products exists along with abrading and grinding tools used mostly for the preparation of red ochre. Then this way of life gradually dies out. One is tempted to explain the change as a function of ecological change. Certainly the fill, which now shows much more aerial deposition than formerly, suggests a change in the river level exposing more sand bars and beaches as a new source of sand. If this were the case, it could in turn reduce the availability for the scavenger birds of the dead salmon which drifted down the river after spawning, for they would not be drifting into the dry, higher sloughs to provide places for the birds to congregate and be taken by the hunters. At this time the glaciers would have largely receded and the volume of the river would have been reduced, and the lower level of the river would have exposed the higher beaches and left the higher sloughs and channels dry. Birds which

had been in the area in such large numbers, as they must have been, would now have had to hunt more widely for their food and the bird population would have thinned out. In this sense, and there seems to be good ground for this hypothesis, it is correct to attribute the change which characterizes the end of the Early period to an ecological condition. However, it is ecological in a degree only, but the single factor of the lowering of the river would have caused a kind of chain reaction. There was no overall ecological change such as characterized the Great Basin during the post-Pleistocene.

One explanation of the sudden disappearance of all kinds of animal bones in the site, and there were none to our amazement in the 1953 pits, that came to mind as quite obvious, was that it marked the beginning of the ceremonial disposal of bones, such as the First Salmon Ceremony. This turned out to be too simple for the Wishram did *not* throw the bones of the salmon back into the river nor as far as we can find out did they ceremonially dispose of other bones. I wrote to Dr. David French who has been working with the Wasco and the Wishram to ask for help, to ask whether the Wasco disposed of salmon and other bones in the river. Dr. French could give no help, for his information is that the Wishram and the Wasco did *not* throw the bones back into the river. We are left with what Dr. French calls the Mystery of the Missing Bones, and no Perry Mason among the anthropologists available has come up with an explanation. The fact remains that after the beginning of the Transitional *no bones* were found in the fill.

The Transitional and the beginning of the Late are contemporary with the Altithermal, the effects of which must have been to cause population shifting with migrations leading outward toward stabilized water and food supplies. The Klamath Lake area (Cressman, 1956) and the Fivemile Rapids Early period had two elements in common, the type of projectile point, and this was alien to the Great Basin to which the early Klamath Lake area culture was related, and the exploitation of the resources of the rivers. The similarity in these two aspects of the culture of these two different areas seems to be too close to be unrelated. If one is derived from the other we do not know the order of derivation. Since they appear to be contemporaneous the influence could have gone either way (*cf.* reference to obsidian flakes in cache in Feature 29, p. 63). This is a hypothesis we are discussing and not a certainty. However, granted this possibility, and also the known fact that hunters did roam the country from the Great Basin to southeastern Washington as long as 9,000 years ago, the Columbia River would reasonably have been a part of the information system of the occupants of the wider area. One is tempted to attribute the stepped-up incidence of use together with the variation in projectile point types which characterized the Late period to the influence of the climatic changes on the population of the Great Basin, an influence which caused population shifts which in turn pressed on those with whom they came in contact and so on. We do not think Jennings and Norbeck's Desert Culture (Jennings and Norbeck, 1955) can be considered to exist in the Columbia Plateau with its many rivers to which adaptation seems rapidly to have taken place. Whatever the explanation of the new cultural developments, it is difficult to see the cause as something inherent in the stable conditions of the Transitional. There could still be, and there was as shown by the artifacts, the tradition of fine stone work and the same pattern of the exploitation of the river, though on a reduced scale.

The end of the Altithermal is set at about 4,500 to 4,000 years ago, and this is not much before the time we think might be assigned to the beginning of the Full Protohistoric. This also could well be the time of the impact of the first Shoshonean-speaking peoples coming filtering into the intermontane region although their full impact was probably later (Cressman, 1956). One item of interest is that the same pattern of order of appearance of point types, that is IV, V, and VI occurs in the upper Roadcut levels, the lower part of Pit 2 and at WS-1, even to Type V appearing one level earlier than either of the others. This evidence may be read to give support either to internal development as the cause of the variation or to in-migration which introduced these different types, which in turn had a slightly different history in their points of origin. Cressman (1956: 465–466) in commenting on the change in the size and varieties of projectile points in the Klamath Lake area wrote:

> On the other hand, it must be kept in mind that there was a proliferation of point types in the Oregon area in late times. We may be dealing with two processes, a diffusion into the area of a series of types which characterize the area of the Great Basin as well as certain processes tending to the proliferation of types, giving the materials with which to work, in this case "small projectile points."

It would be nice if anything more definite than this statement could be made in the present case but we cannot responsibly provide it.

The origin of the elaborate art styles in stone of the Late period is also unknown. It has been customary to think of the stone sculpture and carving to be derivative from the wood carving of the northwest coast. This thesis has been questioned by Drucker (1943) who points out certain similarities between Great Basin sculptures and some from the Columbia in The Dalles area. Assuming a Great Basin origin for rather simple stone sculpture associated with a variety of projectile points including the barbed and shouldered varieties but made almost entirely from obsidian, then, if these people as early "dust bowl refugees" or for whatever reason left the region where obsidian was freely to be had and came to the Columbia where other rocks were used, and these were rocks with a wide range of at-

tractive colors, it does not seem unreasonable to see in this new situation a stimulus which might well have used the skills of these migrants as knappers and caused the eventual development of the highly skilled stone carving and flaking industries. If this were the case, certainly the interior would have given the carving tradition to the coast where it was adapted to a different medium and developed its own style.

We are at a loss to account for the lack of antler digging-stick handles and ear spools in any of our sites. Mr. Cole saw numerous specimens of both these categories when observing for the National Park Service the removal of burials, which Wasco observers insisted were those of their people, from Grave Island at the west end of Fivemile Rapids. He was told by the Indians that the digging-stick handle was made specially for a young girl and given to her as a personal possession which she retained through life. At her death it was buried with her.

Finally, it can be said without much fear of contradiction that will be convincing on the basis of present evidence that the final stage of cultural efflorescence or the Late period was stimulated by some kind of external influence, either contact or in-migration; but, that after the impetus to the elaboration of the art styles in stone began to make itself felt it developed in its own terms so that this whole field of superb aboriginal work stands, with some local variation in style, as a striking feature of the middle Columbia River in the final stages of pre-contact times.

SOCIO-ECONOMIC CONSIDERATIONS

Certain aspects of social and economic factors have been implicit in our previous discussion. Here we shall be concerned with implications of our data for living patterns and site use. The lack of housepits, which we have discussed above, raises the question, were these river-bank sites permanent or did they represent fishing sites occupied for some nine months of the year when salmon were to be taken from the river? The neighboring Tenino had their permanent villages inland from the river. The Wasco villages were supposed to be by the river and Cole's informants at the time of the removal of the bodies from Grave Island pointed out our site WS-1 as the location of their village. No clear-cut evidence of a housepit was found at WS-1 but a depression which had all the appearance of having "been lived in" was found. It appeared to be more of a natural depression of which the inhabitants had taken advantage than a constructed house. In the west face of the Late level in the Roadcut at the beginning of the Full Protohistoric there was a slight depression through which we had cut and in this was a charred timber some three or four inches thick. We could not definitely identify the depression as a housepit but it looked very much like one. In the pits there was likewise no clear evidence of any housepits. There were certain characteristics of the sand in Pit 2 which suggested sand drifted into a pit but the evidence is entirely too tenuous to be used. We have discussed the living areas in the Early period. These would certainly have had only above-ground shelters probably made of branches and mats. There seems to be no evidence here for the rather elaborate semi-subterranean houses described by Lewis and Clark for the Wishram across the river.

The subsistence economy of the Early period was certainly based on the use of fish with some slight addition of small animals with an occasional deer, elk, or bear thrown in, as good luck came to their aid. There is little indirect evidence from tools until the Late period to suggest the use of berries, seeds, and roots. Undoubtedly some of these were used but there does not seem to be sufficient evidence of an established pattern with the accompanying household utensils for manipulation as we find in the Late period. A fragment of a lamp or a grease dish came from the Late at WS-4, and another from WS-1 in 1952.

If the occupation of the sites occurred only for about nine months of the year, there is no break in the artifact distribution at any part of the site to indicate this use. Perhaps any accumulation of debris in that short time would have been too little to leave a record, having been trampled and mixed with the previous material as soon as use began again in the new year. One thing is quite clear and that is that the occupation of the site was continuous from the beginning until the possession of the country by the whites, with perhaps short annual winter breaks due to a shift of dwelling place.

The final situation to which we wish to allude is that by which these people who held the rapids became the "middlemen" of the Columbia region. The Chinook have frequently been spoken of in the literature as living on a trading economy. To an extent this was true. The Wishram-Wasco as the easternmost Chinooks were in the middle between the down-river people and those from the interior. The down-river people came and returned, as did the interior people. In between the important trading seasons there was intermittent contact with visitors from both directions and goods flowed both ways. The Wishram-Wasco, and probably the Wishram because of their position on the more favorable side of the river for transportation, could dominate traffic on the river. They capitalized on their strategic position to collect high fees for assistance to the early trappers and traders in portaging over the rocks. Their position is analogous to those of other people holding like strategic points in the course of world history, people who have enjoyed more attention from historians. Troy comes to mind. In spite of the relative difference between these people on the Columbia and those at Hissarlik, the fundamental situation is the same—control of a strategic point in a line of communication and a resultant cultural diversity. This situation is significant for the

cultural character of the people at the time of white contact, for having received traits from so many different sources, some of which were adopted, others not. Their culture is a mixture of traits from the interior, from down-river and those earlier ones which represent those developed as a basic adaptation to the exploitation of the resources of the river. It is no wonder that to the ethnographer their culture seems to be a mixture of traits of diverse origin.

The archaeological record, if we read it with any close approximation to accuracy, shows that given the adaptation to the riverine ecology, a variety of influences, many of which we interpret as being interior in origin, later impinged on the area; some of these were of course more important than others, but from the Long Narrows on up the Columbia for many miles the culture was peculiarly distinctive, for the people integrated these traits into a significant pattern, which for all its poverty in many ways in material possessions, nevertheless, placed a high value on certain media of aesthetic values, and developed an art form in stone sculpture and artistry in fabrication of stone tools and weapons second to none in native North America.

INTERIOR-COAST RELATIONS

In the present state of our knowledge this point can be summed up very briefly. We know that from the end of the Pleistocene on and perhaps earlier there was a population on the Columbia not far east from the head of tide water, although far from the sea. This knowledge is new. We do not know when people moved down-river to the coast. It obviously could have been anytime after the establishment of settlement at Fivemile Rapids or even before that.

We also know that at Fivemile Rapids they took not only fish for food but land animals and marine mammals from the river. We know that at approximately the beginning of occupation these people had the harpoon (Level 37), a necessary adjunct to maritime adjustment. The bola and the atlatl would have been useful, but no more necessary than they were up river on the Columbia. The food or subsistence pattern early established at the Narrows was mainly based upon fish with a secondary dependence upon marine and land animals and birds, and probably roots and berries in season. This is the essential coastal pattern. The problem that the people with a culture such as this at The Dalles would have met with in moving slowly to the sea would not have been one of a qualitative difference but of a quantitative one. In other words, it certainly would at first have been more of the same and not something entirely different, such as change from a hunting-gathering subsistence characteristic of the interior to a maritime life. Good luck and good archaeology along the coast may well answer the questions of when and where posed above. At present coastal archaeology is beginning to suggest answers.

The results of our archaeological work to date in the Tillamook area, the most southerly of the Coast Salish peoples, separated from the Columbia to the north by the Clatsop of Chinookan stock, point to a fairly late date for the Salishan settlement of the area, something of the order of perhaps 2,000 years ago. Nothing in the artifact inventory from our coast excavations points convincingly to an up-river origin for the culture. Mr. Newman (1959), who has analyzed the Tillamook material, identifies it as straightforward Salish like that of their relatives to the north. It thus appears to represent a southern extension of a maritime culture already well adapted. What might have been the situation on the northern Oregon coast before the Salish occupation is at present unknown. There is nothing at present to indicate any antiquity of permanent coastal occupation comparable to that of the interior intermontane region. The C-14 dates from British Columbia to south of San Francisco all fall into a fairly late pattern of the order of approximately 2,000 years ago. Of course the rising sea level as a result of eustatic adjustment may have destroyed some older sites.

The Chinookan wedge from the Wishram-Wasco at the head of Fivemile Rapids to the mouth of the Columbia River seems, on the basis of present information, to be a late down-river intrusion which effectively separated the Salish groups along the coast. Slow down-river movement and contact with the coast Salish would have permitted acculturation during the process. Then, too, in the light of cultural differentiation except the linguistic at the mouth of the Columbia River, it is possible that, rather than historical separation of Salish groups by a Chinook intrusion, language capture may account for the Chinookan spread in the coast area. It is, of course, possible that the initial Salish occupation really extended well up the Columbia River before the Chinookan thrust down-river. The ethnographic evidence is lacking. These hypotheses would place the beginning of the down-river Chinookan movement quite late historically in Full Protohistoric at The Dalles, about 2,000 years ago, and view it as a slow process building on the elements of riverine adaptation already known but changing through acculturation to the already well-adapted coastal groups.

Finally, writing in a personal vein, as I have worked with this large amount of the remains of the way of life of these people who occupy such a long span in New World history, and as I have discussed points with student and faculty colleagues and we could come to no conclusions as to functions and meanings of artifacts for the people who left them, I have had at times almost a sense of despair at the limits imposed upon the archaeologist by the nature of his data, even when abundant. One feels that the historical situation, like a puzzle, will somehow fall into a meaningful configuration if but one or two missing pieces could be found.

The meaning of a particular complex of artifacts, of a clearly observable method of behavior, draws tantalizingly close, then in a dreamlike lack of clarity of definition, the significance of the evidence forever eludes us. Perhaps it is this condition of our work which has resulted in achaeology being sometimes classed as a science, sometimes as a social science, and again as one of the humanities. One certainly needs to have some of the skill and insight of each of these kinds of methods to understand the fragmentary record and interpret with understanding the message it holds. Our writings are the measure of our skills and our deficiencies. As Santayana has so well said in other context:

> Our knowledge is a torch of smoky pine
> That lights the pathway but one step ahead.

VIII. SPECULATIONS

At the start let me say that I alone am responsible for what appears in this short chapter. I have chosen the title "Speculations" for that is what one should call the things I am going to say. However, the speculations are not just drawn out of a hat but are based upon both theoretical and empirical data studied during some twenty-eight years of active archaeological research and the effort to keep it within the frame of anthropological theory. It is hoped that the "speculations" advanced here may lead to friendly and critical discussion and, if anyone is willing "to buy" any of them, perhaps some of the younger generation which we of the older are helping to train will study them systematically and verify them.

Probably my early program of systematic field work in the Great Basin is responsible in the main for the particular orientation of my thinking on the problems of northwest prehistory. In the Great Basin I was impressed with the importance of the relations between man and his environment both at a given period and through time. The evidence of significant changes in climate in the Great Basin forced me to think in terms of dynamic rather than classificatory relationships. Three questions repeatedly presented themselves: (1) from where did the original Great Basin population come, (2) what happened to it during the great climatic and ecological changes of the post-Pleistocene (Pluvial), and (3) where did the migrants and refugees go who might have been forced out of the Great Basin? There was little known archaeologically about the Great Basin before 1942 and I must say what was presented then was not received with too much approbation. However, more work has essentially substantiated the major theses I advanced at that time and the work of colleagues, especially Jennings and Heizer and their students, has added greatly to our knowledge. Work to the north in the Columbia River basin, in British Columbia in the interior but especially along the coast, in the Aleutians and Arctic areas has also begun to give us a picture of distributions of artifacts in space as well as time, something entirely lacking a few years ago. This beginning of time perspective can now be added to the areal perspective of ethnography to define problems more sharply and, as I think, to give suggestions toward the direction in which those problems may be most usefully formulated.

I, therefore, propose to present certain suggestions toward the formulation of a theory of Northwest prehistory based upon considerations of ecology, the archaeological or ethnographic evidence where it seems to have relation, and linguistic evidence. It must be kept in mind that any culture will change through time and in adaptation to new ecological opportunities. I believe also that the archaeologist as culture historian rather than as artifact taxonomist must, after studying the trees, see them as forest. Consequently, I think it is necessary to try to find patterns or configurations in a cultural manifestation after studying the artifacts. It is these configurations that give one the "feel" of a culture. Relations based on the distribution of a single stone artifact unless it has something unique about it as a type leave much to be desired when one considers the flexibility and inventiveness of the human mind and the relation between stone tool, function, and the limited possibilities of invention. Furthermore, single elements of culture can spread rather easily. Since the archaeologist perforce deals mostly with observed "form" and inferred function, he is more likely to find in a configuration of artifacts a meaningful piece of evidence of population movement than in the use of a single or a series of separate but unrelated specimens. John A. Wilson's "The Burden of Egypt," has always seemed to be an outstanding example of a really great piece of historical reconstruction based upon the "feel" of the artifacts, and of course literary sources of later periods. The same can be said for "The Intellectual Adventures of Ancient Man" by Wilson and his colleagues.

THE ECOLOGICAL EVIDENCE

What we are concerned with from the ecological point of view is how did the ecology relate to the development of Northwest prehistory? I am primarily concerned with the Northwest in the rather restricted sense of Oregon, Washington, British Columbia, Alaska, and the Aleutians. Theoretically, populating of this area could have taken place from the north along the coast, by an interior route, from the interior east of the Rocky Mountains or from the direction of the Great Basin. Our earliest evidence of human occupation in this whole area at the present time is to be found in Oregon with a site closely related in time in southeastern Washington. Some of the evidence as discussed above indicates an occupation some time before the end of the Pleistocene.

During the glacial advances we know that the Coast Range as well as the interior of British Columbia was

heavily glaciated. The interior of British Columbia was certainly impassable during the final stages of the Wisconsin. Any coastal passage would have been an extremely hazardous undertaking except for the most expert sailors. The one unglaciated pass over the Rocky Mountains from the High Plains was the Snake River drainage. During a warm stage of the Wisconsin it is possible that there was a passage available through interior British Columbia but that is unknown at present. If the work of Carter along the California Coast, Meighan in the desert, Harrington's and Simpson's at Tule Springs, and that at Lewisville, Texas, should prove to have produced valid results then certainly it will be necessary to look for an earlier movement of population into the New World than is now generally thought possible. There is a widely spread pattern of C-14 dates over much of North America and to the tip of South America of the order of about 9,000 years ago. The earlier group of dates referred to immediately above generally falls in the range of 25,000 or more years ago. The break in the time sequence of 15,000 years certainly makes the validity of the earlier dates difficult to accept at present. However, their possibility as a valid record of human occupation cannot be ignored and in case they eventually are proved to be correct it will necessitate revamping our thinking on the whole problem. Then the ecological situations of the earlier point in time will be the subject for study rather than of the late Pleistocene. My thinking at present is based upon the later time for settlement while I maintain a skeptical attitude toward the series of earlier dates.

The dry Altithermal period must have exerted a profound influence on the populations of the Great Basin. While the area was not completely depopulated there must have been much out-migration. We now know that the Columbia River and at least parts of that drainage pattern were known to the early Great Basin people. The same is probably true for the Great Basin-California area. Theoretically, then one would expect some of the out-migration to be to the Columbia Plateau to the north. The earliest hunters of big game here would have been in a more favorable environment than to the south. Jennings' Desert Culture (I do not like the name) developed in response to the arid conditions of the Great Basin and while traits might be carried out with migrating people the adaptation of any such group to the different ecological conditions of the Columbia Plateau would result in new traits and different configurations.

The population of the Columbia Plateau, I suggest, would for a long time have been sparse, centered along the rivers, not given to much movement, and the major movement would have been a northward drift on the east side of the Columbia, except perhaps for small adventurous groups which dared to cross the forbidding barrier which the river certainly was at the end of the Pleistocene and for some centuries during the final retreat of the ice. With the retreat of the ice, passage northward into British Columbia would have been possible, moving up the Columbia and the Fraser Rivers, and the latter could also have been followed to the sea (note Borden's C-14 date of $8,150 \pm 310$ years ago for a site near Yale, B.C., in Daugherty, 1958: 454). Passage would also have been open into the Tsimshian country of the extreme north of coastal British Columbia and then on into southwestern Alaska. On the basis of the ecological history of the area such movements, then, could have taken place with the earlier dates appearing in the south. This is the chronological situation we face with the C-14 dates presently available, 10,000 and more years ago on the Columbia and about 3,500 years ago in the Aleutians.

ARCHAEOLOGICAL EVIDENCE

Twined basketry, Catlow twine, with false embroidery occurs archaeologically from southern Oregon to the Columbia River. It next appears among the Tlingit and extends on out into the Aleutians. I have no dates on the Aleutian specimens but I identified pieces of this material in Heizer's collection from Kodiak Island. The intervening area is so unknown that nothing may reasonably be postulated for it. However, the Tlingit basketry, except for the materials from which it is fabricated is so like the Catlow twine that one is hard put to it to see independent invention. Catlow twine with false embroidery has a C-14 date of about 9,000 years ago.

Atlatls raise again the question in one's mind. In Fort Rock I excavated, and reported in 1942 on what I identified, and I am sure correctly, as an atlatl spur or hook. The atlatl for the southwestern United States and into south-central Oregon has the spur as a part of the atlatl. The Eskimo, the Aleuts, and the Tlingit make the spur by inserting a piece of bone in the distal end of the atlatl groove. Riddel has identified one, and perhaps two stone pieces from an excavation in northeastern California, as atlatl spurs. To the Fort Rock and northeastern California specimens we now have to add the Columbia weapons from Fivemile Rapids. (A collector in 1958 brought into this department a collection excavated from a cave in the Fort Rock area in which were two bone atlatl hooks extraordinarily like those from Fivemile Rapids.) Here is a trait which certainly suggests relations with the northern type of weapon.

Bolas found with the bird bones at Fivemile Rapids have their closest counterpart among the northwest Eskimos.

The complex of beveled antlers, pounders, and cylinders associated with types of points certainly to be classed with our Type I, and blades, found by MacNeish at the Engigstciak Site on the Yukon Arctic Coast and called the Pointed Mountain Complex is a

striking parallel to our Full Early at Fivemile Locks. Caribou furnished the horn and bone for the Pointed Mountain Complex and that is to be expected in caribou country. MacNeish told me that the Eskimos told him that the bevels were for smoothing hides and the cylinders for flaking tools. MacNeish wrote Cressman under date of November 3, 1958, as follows:

> Thank you very much for your manuscript on the cultural sequences at The Dalles, Oregon. I read it with interest when I got back from the field. Amazingly enough, the new material I found in connection with my second culture, on the Firth River, called Flint Creek, seems to be tied in very closely with your earliest levels. The scraper planes, pebble choppers, flake burins, large crude blades, and double-pointed lenticular projectile points, the needles, and the fish spears are all held in common. When I get some photographs done of the Flint Creek material, I'll send you copies, when I believe you will see that these cultures are fairly close. Perhaps we might get together and discuss the matter of possible relationships between the two, for I certainly think they are related.

Our plumb-bob type of instrument appears in the Aleutians as does apparently the bola in the Nikolski site excavated by Laughlin. Another specimen from our Pit 5 which is found in this area of the Columbia and sometimes referred to as an atlatl weight (without real justification) appears in a slightly modified form in Alaska (fig. 58). The Alaskan form has longitudinal grooves and ours has only a medial transverse one.

This series of traits, all of which are found in our Full Early on the Columbia, strongly suggests that there must be some derivative relationship between the two areas. On the basis of the time gradient as shown by C-14 dates the derivation would have to be from the south for there on the Columbia at Fivemile Rapids are the earliest manifestations of these configurations. Given the ecological situation previously described of the withdrawing glaciers it is not too difficult to speculate that we have here manifestations of the northward movement of peoples, perhaps those and others with related culture, about whose fate we were puzling at the termination of the Early period at The Dalles.

LINGUISTIC EVIDENCE

When Sapir proposed a reclassification of the Indian languages of North America he began to make forests out of the trees. If one looks carefully at the map prepared by the Voegelins to present Sapir's classification he is at once struck by the distribution of stocks in the Pacific Northwest and the potential meaning for historic reconstruction on a broad scale.

Sapir's Penutian stock was apparently that of the old Great Basin populations. The scattered distributions of the Penutian in California and along the Oregon coast may very well represent earlier migrant populations from the Great Basin. If the assumption that Penutian was the original language of the Great Basin is accepted then it must have extended north with the expansion of the hunting peoples into the Columbia Plateau. It is not difficult to picture a thinly scattered population moving north and carrying a language which is now no longer in evidence. Far to the north along the Skeena and Nass Rivers are the Tsimshian speaking a Penutian language. There is obviously some relationship here to the main part of the stock. The Salish are classed as an Algonquian group and the western extension of this stock cuts across to the coast and down into Washington where it meets the Penutian stock. To me it makes sense to picture the Algonquian (Salish) as later arrivals spreading across this northern belt and thrusting into previously held Penutian territory. This would have pushed the Penutians southward, back on their fellows so to speak, and perhaps account for the isolation of the Tsimshian. The loss of islands of Penutian in the territory overrun by the Salish could be accounted for either by language capture or extinction, probably the former. The same process in the northern area can be visualized with the later Athabascan immigrants. If language capture is conceived of as the device by which a language may spread in a contiguous area without physical movement of groups of people which displace earlier inhabitants, then we have a device by which language would change in an area but the fundamental complexes of the culture would not, whereas they necessarily would change if occupation was by violent means.

The apparent similarities between various configurations of artifacts to be found in the extreme northwest of North America and the area of the Northern Great Basin and the Columbia River in the Fivemile Rapids area, the ecological considerations relevant to the problem, suggestions derivative from linguistic distributions, and the markedly earlier appearance of the artifacts in question in Oregon suggest that the point of origin for these complexes in the north is to be found in the south in the riverine adaptation to the Columbia River system. The northern manifestations probably represent adaptations throughout a long period of time to a new environment during which new traits were developed internally and borrowed from other sources to give the northern cultures their final character.

Only systematic, well carried out research and remarkably good luck will verify any of the speculations advanced here. Maybe I am talking about bushes, and neither trees nor forests. I do not think so, and I pass these suggestions on for archaeologists of the next twenty-five years who will exploit the rapidly changing field of our discipline.

APPENDICES

A. MOLLUSCA

WS-4 Roadcut, Oregon

REPORT ON REFERRED FOSSILS

DWIGHT W. TAYLOR

Stratigraphic range: Pleistocene	Kinds of Fossils: Mollusks
General Locality: Oregon	Shipment No.: 0-56-32
Referred by: L. S. Cressman	Letter/memo dated: Feb. 3, 1956
Branch: Outside	Date material received: Feb. 8, 1956
Report prepared by: D. W. Taylor	Date of report: May 2, 1956

Shells from several levels in University of Oregon excavations east of The Dalles, Oregon.

Level 31. Stagnicola palustris (Müller)
Gyraulus parvus (Say)

Test pit, Levels 31 and 32. Stagnicola palustris (Müller)
Gyraulus parvus (Say)
Armiger crista (Linné)
Helisoma sp. ref. H. subcrenatum (Carpenter)
Fluminicola nuttalliana (Lea)

Level 35. Stagnicola palustris (Müller)
Gyraulus parvus (Say)
Armiger crista (Linné)
Helisoma subcrenatum (Carpenter)

Level 37. Stagnicola palustris (Müller)
Gyraulus parvus (Say)
Armiger crista (Linné)

Level 38. Stagnicola palustris (Müller)
Gyraulus parvus (Say)
Armiger crista (Linné)
Helisoma subcrenatum (Carpenter)

Test pit, Levels 38 and 39. Gyraulus parvus (Say)
Physa sp., too young for identification

The mollusks from all levels belong to one kind of habitat, with the exception of *Fluminicola* from the test pit in Levels 31 and 32. This habitat, which seems to have endured throughout the interval recorded by the mollusks, is one of shallow, quiet water, probably drying up largely or entirely during the summer. The *Fluminicola*, however, is strictly a permanent stream-dweller, and was washed in from the main Columbia River or a perennial side-channel with moderate current.

Stagnicola and *Gyraulus* are common, *Armiger* less so, and *Helisoma, Physa,* and *Fluminicola* rare. The *Stagnicola* and *Gyraulus* are widespread species characteristic of shallow pools and ponds or quiet water along the edges of streams. They are found in permanent or temporary water bodies, but a restricted fauna in which these two predominate suggests semi-permanent or temporary situations. *Armiger* is poorly known, but seems to be characteristic of temporary ponds. *Helisoma* and *Physa* fit in with this environmental picture. The small number of specimens of these two suggests the possibility that they could have been brought in by the river. The larger number of specimens of the other species and the lack of obvious signs of wear on the shells make transport less likely.

Considering both the species' habitats and the situation from which these shells come, I believe the local environment included pools on the river flood plain which dried up during summer, and which had a good growth of aquatic plants such as cattails and algae. The absence of land snails may indicate lack of habitats suitable for them, but sampling error could be responsible.

All six species are still living in the region of the fossil occurrence. They give no indication of a former climate different from that of the present, nor is there evidence of climatic change within the sequence. I find no reliable evidence of local habitat change within the sequence, either. For these reasons I cannot say whether the shells are Pleistocene or Recent, or that they could or could not come from the Altithermal.

B. ARTIFACT INVENTORY

Burial No. 1 WS-4

Stones	
Strike-a-light—petrified wood	1
Points (Type 3A & Frag.)	2
Steatite cup	1
Steatite pipe	1
Beads	2
Gun flint	1
Bone & Shell	
Elks' teeth	10
Beads	2
Dentalium frag.	36
Metal	
Hatchet head	1
Adze blade	1
Sturgeon hooks	2
Knife blade	1
Knife blade, double-fish scaler	1
Knife blade, copper handle	1
Knife blade, bone handle	1
Knife blade, wood handle	1
Copper knife handle frag.	1
Buttons (Plain) Copper, 15 mm.	1
Buttons (Plain) Copper, 17 mm.	22
Buttons (Plain) Copper, 18 mm.	6
Buttons (Plain) Copper, 20 mm.	2
Buttons Phoenix	4
Buttons—Writing on back, 14 mm.	1
Buttons—Writing on back, 17 mm.	1
Northwest token 1820 (Copper)	1
Chinese copper coins	2
Metal discs (copper) plain	2
Metal discs (copper) decorated	11
Bead copper	1
Copper ring over bears' claw	1
Harpoon-composite, bone & metal	2
Copper eyelets with copper springs	2
Metal fragments	many
Glass	
Mirror & frags.	1
Beads	226
	352

Burial No. 2 WS-4

Metal Knife—wood handle	1
Iron with hole in it	1
Dentalium	1
Strike-a-light—Petrified wood	1
Pounding stone	1
End scraper	1
Side scraper	1
Glass beads	145
	152

C. BIRD BONES

WS-4 Roadcut, Oregon

TOTAL INDIVIDUALS AND PER CENTS BY LEVELS

Lev.	Cormorant		Duck		Goose		Condor		Turkey Vulture		Bald Eagle		Hawk		Sparrow Hawk	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
20	1	1			2	22					1	1				
21																
22	1	1					1	1			2	2				
23																
24	1	1							1	8	1	1	1	33		
25	5	4			2	22	1	1			4	3				
26	7	6									5	4				
27	17	14	1	100			4	6			10	8			2	40
28	27	23			2	22	13	20	4	31	32	26			1	20
29	29	25			2	22	17	27	2	15	23	19				
30	22	19			1	11	15	26	2	15	26	21	1	33	1	20
31	4	3					9	14	3	23	11	9				
32	2	2					3	5	1	8	5	4	1	33	1	20
33																
34																
35																
36	1	1									1	1				
Unk.	1	1									1	1				
Total	118	100	1	100	9	100	63	100	13	100	122	100	3	100	5	100
% of Total	*18.9*		*.16*		*1.4*		*10.2*		*2.08*		*19.6*		*.48*		*.8*	

TOTAL INDIVIDUALS AND PER CENTS BY LEVELS

Lev.	Gull		Screech Owl		Crow		Raven		Magpie		Passerine		Coragyps		Falcon	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
20							1	.08								
21																
22	4	1.5														
23																
24	2	.9														
25	15	6.0														
26	24	9.0									1	100				
27	49	19.0					3	.25	1	.33						
28	69	26.0					4	.33	1	.33			1	100		
29	37	14.0	1	50	3	37										
30	45	17.0			5	63	3	.25							1	100
31	5	2.0					1	.08								
32	5	2.0	1	50					1	.33						
33																
34																
35																
36	3	1.1														
Unk.	4	1.5														
Total	262	100.0	2	100	8	100	12	100	3	100	1	100	1	100	1	100
% of Total	*42.0*		*.32*		*1.2*		*1.9*		*.48*		*.16*		*.16*		*.16*	

Total Individuals—624—A minimum of individuals—"There may have been 10 bones of a species, but all of them may have been different segments of the same skeleton. They would be listed as one." (Note from Dr. Miller's report to L.S.C. on the identification and distribution of bird bones, Feb., 1956.)

D. MAMMAL BONES

WS-4 Roadcut, Oregon

MINIMUM NUMBER OF INDIVIDUALS BY LEVEL

Lev.	Taxidea		Vulpes Fulva		(Striped Skunk) Mustelid		Sm. Carnivore		Felis		Thomomys		Rabbit		Muskrat	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
20			1	20												
21					1	20	1	25					1	25		
22	1	33.3														
23																
24					1	20					1	14.3				
25	1	33.3	1	20							1	14.3	1	25	1	25
26	↑				1	20					↑		1	25		
27													↑		1	25
28			1	20							1	14.3				
29	1	33.3					1	25			2	28.5	1	25		
30	↑				1	20									1	25
31							1	25			1	14.3				
32							1	25								
33			1	20	1	20					1	14.3				
34											↑					
35			1	20					1	100						
36																
37															1	25
Total	3	99.9	5	100	5	100	4	100	1	100	7	100	4	100	4	100
% of Total	*3.0*		*6.0*		*6.0*		*4.6*		*1.0*		*8.0*		*4.6*		*4.6*	

MINIMUM NUMBER OF INDIVIDUALS BY LEVEL

Lev.	Beaver		Marmot		Cervid		Human		Phocid		Canid		Lg. Carnivore		Misc. Rodent		Land Otter	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
20									1	16.7								
21			1	7.2	1	9									1	12.5		
22			↑		1	9					1	16.7			1	12.5		
23			1	7.2														
24	1	16.7	1	7.2							1	16.7						
25	↑		3	21.6	2	18					↑				2	25.0		
26			2	14.0	1	9									↑			
27			1	7.2	1	9					↓				1	12.5		
28	2	33.2	1	7.2	↑		1	100	2	33.2	2	33.2			1	12.5		
29	↑		2	14.0	2	18			↑		↑						1	100
30	1	16.7	1	7.2	1	9			1	16.7	1	16.7			1	12.5		
31			↑												1	12.5		
32	1	16.7							1	16.7			1	100				
33																		
34					1	9												
35	1	16.7			1	9												
36					↑				1	16.7	↓							
37			1	7.2							1	16.7						
Total	6	100	14	100	11	99	1	100	6	100	6	100	1	100	8	100	1	100
% of Total	*7.0*		*16.0*		*13.0*		*1.0*		*7.0*		*7.0*		*1.0*		*9.2*		*1.0*	

Total Individuals—87. After completion of excavation in further salvage efforts, Cole found the mandible of a large black bear and the burr of an elk antler which measured 10.5 cm. in maximum diameter. Bones from level containing the arrow do not conclusively demonstrate presence of more individuals than number given in level indicated by arrow, and appear to be separated by arbitrary nature of levels.

E. DISTRIBUTION OF SELECTED CLASSES OF ARTIFACTS

WS-4 Roadcut, by 20 cm. Levels

LEVELS	POINTS, TYPE I	POINTS, TYPE II	POINTS, TYPE III	POINTS, TYPE IV	POINTS, TYPE V	POINTS, TYPE VI	BLADES, TYPE A	BLADES, TYPE B	CHOPPERS, CLASS C	P. F. COBBLES	GRAVING TOOLS	BURINS	SIDE POLISHERS	BOLAS, GIRDLED	LEVELS
1	5	40	8	2	6	4	2	4	25	58	88	1			1
2	9	14	4	1	2	1	2	3	13	44	44	2	3		2
3	1	7	1		1		2	1	9	21	38				3
4	5	9	3				2	2	21	19	23	1		1	4
5	3	11					2	1	30	12	16				5
6	3	2	1					3	53	21	29		1		6
7	9						2		33	14	26		1		7
8	7							1	46	16	17	1	1		8
9	2								21	9	7				9
10	4						1		26	6	8		1		10
11								1	26	4	3		3		11
12									26	3	7				12
13	1								10		5				13
14									7		1				14
15								1	5						15
16									11	1	1		1		16
17									6		1				17
18									11		1				18
19							1		11	1	2				19
20	3						2	2	12		7		2		20
21	1						1	2	21		1				21
22	3						2		33	1	4	2	3		22
23	1							2	8		1	3	2	1	23
24	2						1	3	5		3		1		24
25							5	5	21		9	1	2	1	25
26	1						5	6	32		6	2	5	1	26
27	2						6	13	33		6	2	5		27
28	1						18	14	30		2	5	6	3	28
29	8						13	21	47		6	5	10	4	29
30	5						30	22	33		8	11	5	8	30
31	5						8	11	8		1	2	1	4	31
32							3	5	5			1	3	1	32
33							1							2	33
34												1			34
35	1						1	1					2		35
36								1	1						36
37								1				1			37

BIBLIOGRAPHY

ALLEN, PAUL, ed. 1902–06. History of the expedition under the command of Captains Lewis and Clark. (A complete reprint of the Biddle Edition of 1814 to which all the members of the expedition contributed.) 3 v. New York, Allerton Book Co.

ANTEVS, ERNST. 1925. On the Pleistocene history of the Great Basin. *Carnegie Institution of Washington, Publ.* **352**: 51–114. Washington, D. C.

——. 1948. III—Climatic changes and pre-white man. In: The Great Basin, with emphasis on Glacial and Postglacial times. *Univ. of Utah, Bull.* **38** (20): 168–191. Salt Lake City.

BAILEY, VERNON. 1936. The mammals and life zones of Oregon. *North American Fauna* **55**. U. S. Dept. of Agri., Bur. of Biol. Sur., Washington, D. C.

BARENDSEN, G. W., E. S. DEEVEY, AND L. J. GRALINSKI. 1957. Yale natural radiocarbon measurements III. *Science* 126: 908–919. Washington, D. C.

BARNETT, H. G. 1937. Culture element distributions: VII, Oregon coast. *Anth. Records* **1** (3): 155–204. Berkeley, Univ. of California Press.

BERREMAN, JOEL V. 1937. Tribal distribution in Oregon. *Memoirs, Amer. Anth. Assoc.*, No. 47. Suppl. to Vol. 30, No. 3, Part 2. Menasha.

BOAS, FRANZ. 1902. The Jesup North Pacific Expedition. *Proc. Int. Cong. of Americanists,* 13th Session, New York, 91–100.

BORDEN, CHARLES E. 1950. Prelim. report on archaeological investigations in the Fraser delta region. *Anthropology in British Columbia,* No. 1: 13–27, British Columbia Provincial Museum, Dept. of Education, Victoria.

——. 1951. Facts and problems of northwest coast prehistory. *Anthropology in British Columbia,* No. 2: 35–52, British Columbia Provincial Museum, Dept. of Education, Victoria.

——. 1954. Some aspects of prehistoric coastal-interior relations in the Pacific Northwest. *Anthropology in British Columbia,* No. 4: 26–31, British Columbia Provincial Museum, Dept. of Education, Victoria.

BORDES, FRANÇOIS, AND M. BOURGON. 1951. Le Complexe Moustérien. Moustériens, Levalloisien et Tayacien. *L'Anthropologie* **55** (1–2): 1–23. Paris.

BRETZ, J. HARLAN. 1925. Spokane flood beyond the channeled scablands. *Jour. of Geology* **33** (2): 97–115. Chicago.

Brief in support of proposal for a Museum of Natural History of the Columbia River Region at The Dalles, Oregon, compiled by L. S. Cressman. The Chamber of Commerce, The Dalles. No date.

CALDWELL, WARREN WENDELL. 1956. The archaeology of Wakemap. A stratified site near The Dalles of the Columbia. Ph.D. thesis, Univ. of Washington, Seattle.

CARTER, GEORGE F. 1952. Interglacial artifacts from the San Diego area. *Southwestern Jour. Anth.* **8** (4): 444–456. Albuquerque.

CHILDE, V. GORDON. 1956. Piecing together the past. New York, Frederick A. Praeger.

CLARK, J. G. D., F. B. A. 1954. Excavations at Star Carr. An early Mesolithic site at Seamer, near Scarborough, Yorkshire. Cambridge University Press.

COLE, DAVID L. 1954. A contribution to the archaeology of The Dalles region, Oregon. M.S. thesis, University of Oregon.

COLLIER, DONALD, ALFRED E. HUDSON, AND ARLO FORD. 1942. Archaeology of the Upper Columbia Region. *Univ. of Washington Pubs. in Anth.* **9** (1): 1–178. Seattle.

Corps of Engineers. 1952. Columbia River, Northwestern United States, in eight volumes, Vol. 1, 81st Congress, 2nd Session, *House Document* No. 531. Government Printing Office, Washington.

CRESSMAN, L. S., and collaborators. 1942. Archaeological researches in the Northern Great Basin. *Carnegie Institution of Washington, Publ.* **538**.

CRESSMAN, L. S. 1950. Archaeological researches in the John Day Region of North Central Oregon. *Proc. Amer. Philos. Soc.* **94** (4): 369–390. Philadelphia.

——. 1951. Western prehistory in the light of carbon 14 dating. *Southwestern Jour. of Anth.* **7** (3): 289–313. Albuquerque.

——. 1956. Klamath prehistory. *Trans. Amer. Philos. Soc.* **46** (4). Philadelphia.

CROOK, W. W., JR., AND R. K. HARRIS. 1958. A Pleistocene campsite near Lewisville, Texas. *Amer. Antiquity* **23** (3): 233–246. Salt Lake City.

DAUGHERTY, RICHARD D. 1956. Archaeology of the Lind Coulee site, Washington. *Proc. Amer. Philos. Soc.* **100** (3): 223–278. Philadelphia.

——. 1958. Notes and news in *American Antiquity* **23** (4). Salt Lake City.

DAVIS, N. F. G., AND W. H. MATHEWS. 1944. Four phases of glaciation with illustrations from southwestern British Columbia. *Jour. of Geology* **52** (6): 403–413. Univ. of Chicago Press.

DRUCKER, PHILIP. 1936. Diffusion in northwest coast culture in the light of some distributions. Ph.D. dissertation, Univ. of California.

——. 1937. The Tolowa and their southwest Oregon kin. *Univ. of Calif. Publ. in Amer. Arch. and Ethnol.* **36** (4): 221–300. Berkeley.

——. 1943. Archaeological survey on the northern northwest coast. *Bur. of Amer. Ethnol. Bull.* **133**.

——. 1955*a*. Indians of the northwest coast. New York, American Museum of Natural History.

——. 1955*b*. Sources of northwest coast culture. In *New Interpretations of Aboriginal American Culture History.* 75th Anniversary Volume of the Anthropological Society of Washington, 59–81. Washington, D. C.

GONZALES, ALBERTO REX. 1953. La Boleadora. Sus Areas de dispersion y tipos. Extracto de la Revista del Museo de *La Universidad Eva Peron Mus. Serie* Tome IV Session Antropologia, 133–292.

GUNTHER, E. 1926. An analysis of the first salmon ceremony. *Amer. Anth.*, n. s., **28**: 605–617. Menasha.

HARRINGTON, M. R. 1933. Gypsum Cave, Nevada. *Southwest Museum Papers,* No. 8. Los Angeles.

HIBBEN, FRANK C. 1941. Evidence of early occupation in Sandia Cave, New Mexico, and other sites in the Sandia-Manzano region. *Smithsonian Misc. Colls.* **99** (23). Washington.

HODGE, FREDERICK WEBB, ed. 1912. Handbook of Indians north of Mexico. *Bur. of Amer. Ethnol. Bull.* **30**. 2 v. Washington, D. C.

JACOBS, MELVILLE. 1937. Historic perspectives in Indian languages of Oregon and Washington. *Pacific Northwest Quarterly* **28**: 55–74. University of Washington, Seattle.

JENNINGS, JESSE D. 1957. Danger Cave. Memoirs of the Society for American Archaeology, 14. *Amer. Antiquity* **23** (2), Part 2, Oct. Salt Lake City.

JENNINGS, JESSE D., AND EDWARD NORBECK. 1955. Great Basin prehistory: a review. *Amer. Antiq.* **21** (1): 1–11.

KELLAR, JAMES H. 1955. The Atlatl in North America. *Prehistoric Research Series* **3** (3), June. Indiana Historical Society, Indianapolis.

KING, ALDEN R. 1950. Cattle Point, a stratified site in the southern northwest coast region. *Amer. Antiquity* **15** (4), Part 2, Memoir 7. Menasha.

KROEBER, A. L. 1923. American culture and the northwest coast. *Amer. Anth.*, n. s., **25** (1): 1–20. Menasha.

——. 1939. Cultural and natural areas of native North America. *Univ. of Calif. Publ. in Amer. Arch. and Ethnol.* **38**. Berkeley.

LAWRENCE, D. B. 1948. Mt. Hood's latest eruption and glacier advances. *Mazama* **30** (13): 22–29.

LEWIS, ALBERT BUELL. 1906. Tribes of the Columbia Valley and the coast of Washington and Oregon. *Memoirs. Amer. Anth. Assoc.* **1** (2). Lancaster.

LIBBY, WILLARD F. 1952. Radiocarbon dating. Chicago, Univ. of Chicago Press.

——. 1955. Radiocarbon dating. Second ed. Chicago, Univ. of Chicago Press.

MACNEISH, RICHARD S. 1956. The Engigstciak site on the Yukon Arctic coast. *Anthropological Papers of the University of Alaska* **4** (2): 91–111. College, Alaska.

MATHEWS, W. H. 1944. Glacial lakes and ice retreat in South-Central British Columbia. *Trans. Roy. Soc. of Canada*—Section IV, 39–57.

——. 1951. Historic and prehistoric fluctuations of Alpine glaciers in the Mount Garibaldi map-area, Southwestern British Columbia. *Jour. of Geol.* **59** (4): 357–380.

MILLER, L. 1957. Birds from an Oregon Indian midden. *The Condor* **59**: 59–63.

MOONEY, JAMES. 1896. The ghost dance religion and the Sioux outbreak of 1890. *14th Ann. Report, Bur. Amer. Ethnol.* Washington, D. C.

NEWMAN, THOMAS M. 1959. Tillamook prehistory and its relation to the northwest coast culture area. Ph.D. dissertation, University of Oregon, Eugene.

ORR, PHIL C. 1956. Pleistocene man in Fishbone Cave, Pershing County, Nevada. Bull. No. 2. The Nevada State Museum, Dept. of Archaeology, Carson City.

OSBORNE, DOUGLAS. 1957. Excavations in the McNary Reservoir Basin near Umatilla, Oregon, with appendixes by Marshall T. Newman, Arthur Woodward, W. J. Kroll and B. H. McLeod. *River Basin Survey Papers,* No. 8. Smithsonian Institution, *Bur. Amer. Ethnol. Bull.* **166**, Washington.

RAY, VERNE F. 1939. Cultural relations in the plateau of northwestern North America. *Publs. of the Frederick Webb Hodge Anniversary Publ. Fund* **3**. Los Angeles, The Southwest Museum.

RAY, VERNE F., and others. 1938. Tribal distribution in eastern Oregon and adjacent regions. *Amer. Anthropologist* **40** (3): 384–415.

ROGERS, M. J. 1939. Early lithic industries of the lower basin of the Colorado River and adjacent areas. *San Diego Mus. Papers* **3**: 1–75. Denver.

SAPIR, EDWARD. 1907. Preliminary report on the language and mythology of the Upper Chinook. *Amer. Anth.,* n. s., **9**: 533–544. Lancaster.

——. 1909. Wishram texts, together with Wasco tales and myths. *Publ. Amer. Ethnol. Soc.* **2**. Leyden.

SAUER, CARL O. 1957. The end of the Ice Age and its witnesses. *Geographical Review* **47** (1): 29–43. American Geographical Society, New York.

SHEPARD, F. P., AND H. E. SUESS. 1956. Rate of postglacial rise of sea level. *Science* **123**: 1082–1083. Washington, D. C.

SHINER, JOEL L. 1951. The excavations at site 35-UM-5 in the McNary Reservoir, Oregon. Smithsonian Inst., River Basin Surveys, Columbia Basin Project, 1–29. Eugene. Mimeo.

SKINNER, MORRIS F., AND O. C. KAISEN. 1947. The fossil bison of Alaska and preliminary revision of the genus. *Bull. Amer. Mus. of Nat. Hist.* **89**, Art. 3: 127–256. New York.

SMITH, MARIAN W. 1950. Archaeology of the Columbia-Fraser region. *Amer. Antiquity* **15** (4), Part 2, Memoir 6. Menasha.

SPIER, LESLIE. 1930. Klamath ethnography. *Univ. of Calif. Publ. in Amer. Archaeol. and Ethnol.* **30**. Berkeley.

SPIER, LESLIE, AND EDWARD SAPIR. 1931. Wishram ethnography. *Univ. of Washington Publ. in Anthropology* **3** (3). Seattle. (Listed as Vol. 3, 1929–30. Publ. date is 1931.)

STRONG, W. DUNCAN, W. EGBERT SCHENCK, AND JULIAN H. STEWARD. 1930. Archaeology of The Dalles-Deschutes region. *Univ. of Calif. Publ. in Amer. Arch. and Ethn.* **29** (1): 1–154. Berkeley.

SWANTON, JOHN R. 1952. The Indian tribes of North America. *Bur. of Amer. Ethnol. Bull.* **145**. Washington.

TEIT, JAMES. 1928. The Middle Columbia Salish. *Univ. of Washington Publ. in Anthropology* **2** (4): 83–128. Ed. by Franz Boas. Seattle.

United States Department of Agriculture. 1941. Yearbook of Agriculture, Climate and Man, Washington, D. C.

VOEGELIN, C. F., AND E. W. VOEGELIN. 1941. Map of North American Indian languages. Publ. by the American Ethnol. Soc. in collaboration with Indiana University. Publ. No. 20, American Ethnol. Soc., Menasha.

Wasco County Planning Commission, Wasco Co., Oregon. 1954. The character of Wasco County. Wasco County Planning Commission. The Dalles, 1–47. Mimeo.

WORMINGTON, H. M. 1957. Ancient man in North America. Denver Museum of Natural History, Denver.

FIG. 29. Aerial view of Fivemile Rapids showing archaeological locations; course of river down to left.

FIG. 30. Aerial view of WS-4 Site. Roadcut site is at light area of cut on south side just in rear of westbound car; numbered squares show location of pits of 1953 season; current flows from reader's right to left.

FIG. 31. Roadcut exposure partially cleared; trench and pit from winter test; dragline scars are on the hardpan.

FIG. 32. Roadcut at end of excavation. Lower stadia rod is 4 m. and upper 3 m. long. *X* axis is parallel to face of exposure and various *Y* axes are shown by the stakes. Grid is from 0X–12X and 0Y–12Y.

FIG. 33. WS-4, Roadcut site with water of The Dalles Reservoir at the 155′ level, backing into abandoned U. S. 30 as it formerly backed into the old channel.

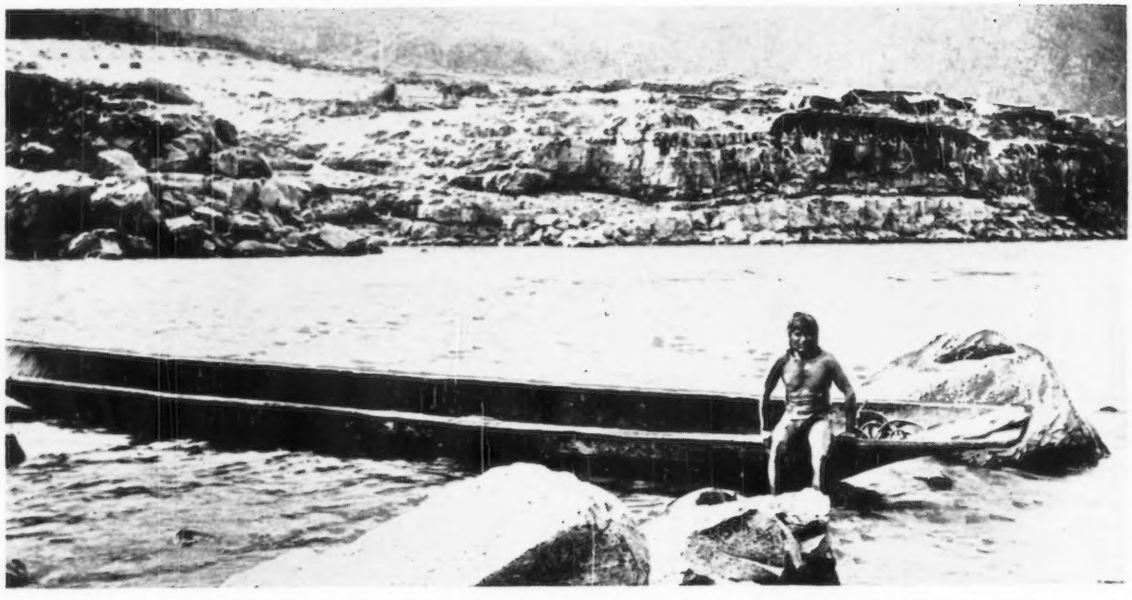
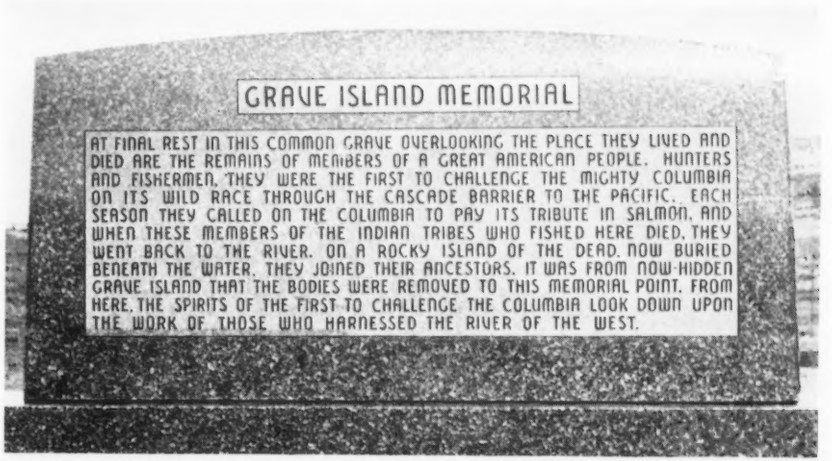


FIG. 34. Indian in shovel nose (up river type) canoe. Photo by Benjamin Gifford, 1897. The Dalles.

FIG. 35. Indians fishing at Celilo Falls. Photo by D. L. Cole.


GRAVE ISLAND MEMORIAL
AT FINAL REST IN THIS COMMON GRAVE OVERLOOKING THE PLACE THEY LIVED AND DIED ARE THE REMAINS OF MEMBERS OF A GREAT AMERICAN PEOPLE. HUNTERS AND FISHERMEN, THEY WERE THE FIRST TO CHALLENGE THE MIGHTY COLUMBIA ON ITS WILD RACE THROUGH THE CASCADE BARRIER TO THE PACIFIC. EACH SEASON THEY CALLED ON THE COLUMBIA TO PAY ITS TRIBUTE IN SALMON. AND WHEN THESE MEMBERS OF THE INDIAN TRIBES WHO FISHED HERE DIED, THEY WENT BACK TO THE RIVER. ON A ROCKY ISLAND OF THE DEAD, NOW BURIED BENEATH THE WATER, THEY JOINED THEIR ANCESTORS. IT WAS FROM NOW-HIDDEN GRAVE ISLAND THAT THE BODIES WERE REMOVED TO THIS MEMORIAL POINT. FROM HERE, THE SPIRITS OF THE FIRST TO CHALLENGE THE COLUMBIA LOOK DOWN UPON THE WORK OF THOSE WHO HARNESSED THE RIVER OF THE WEST.

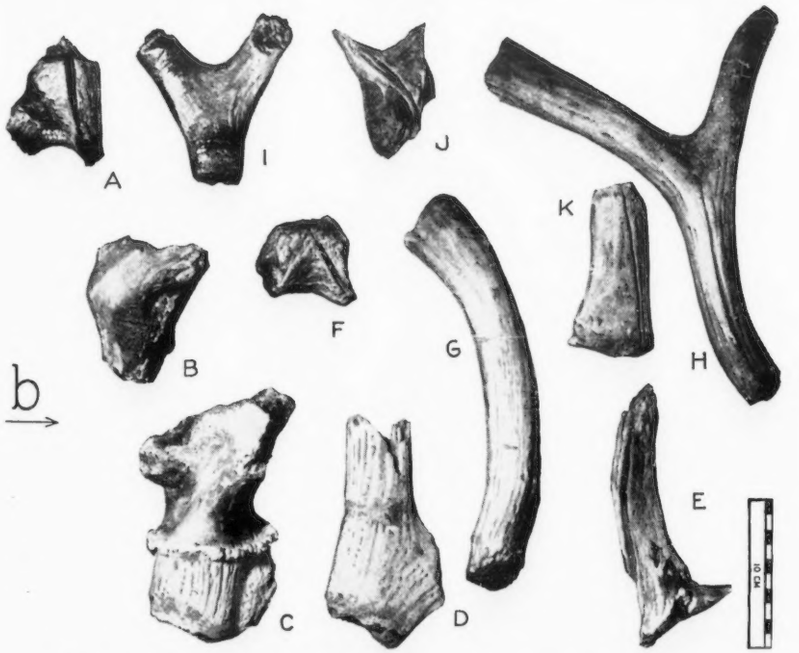


FIG. 36 (*upper right corner*). Memorial at the common grave of the remains of the Wasco Indians removed from Grave Island on high point overlooking Big Eddy and part of the former "Long Narrows."

FIG. 37. Antler tines. *a*. Tines and tine flakers. *b*. Worked pieces: beam bases with portions of frontal and parietal bones, B–C; beam bases with or without tines, D–G; beam fragments, A, F, I, J; tines, E, H, K.

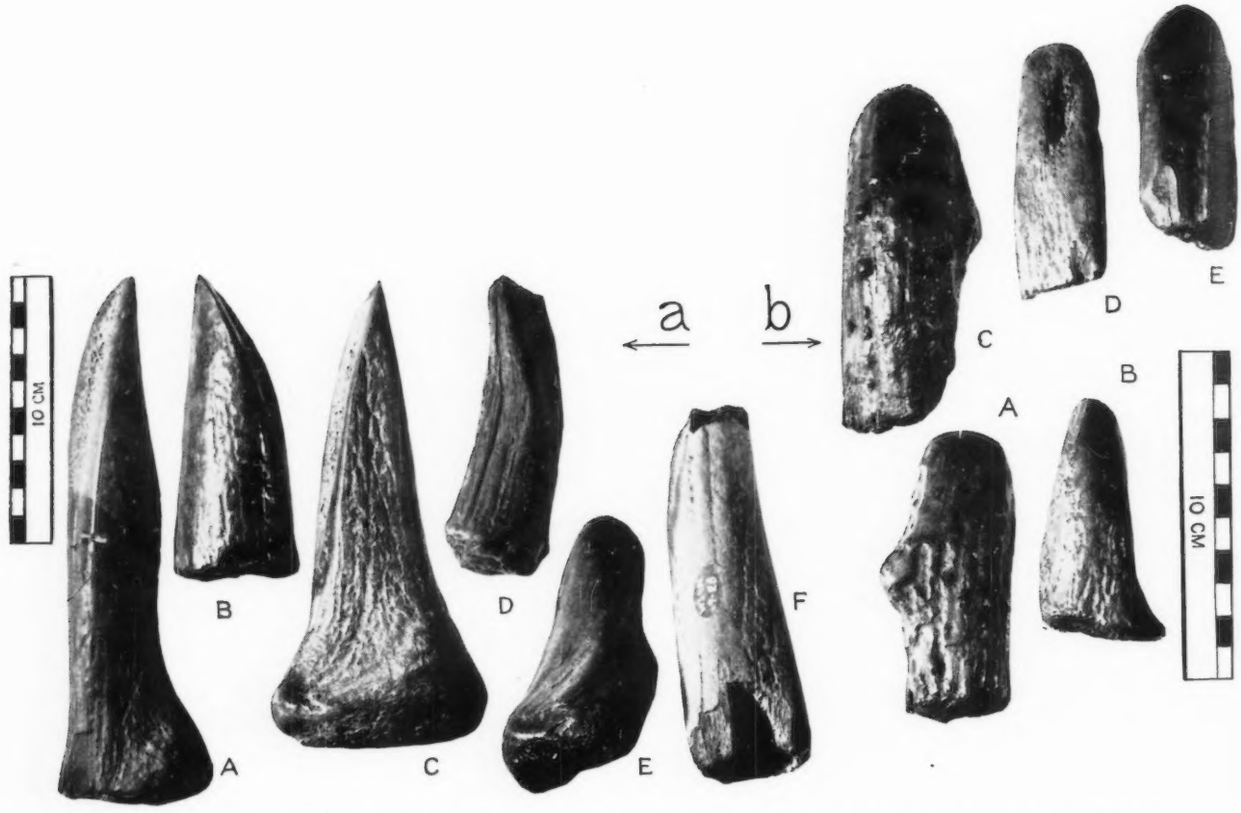


FIG. 38. Antler bevel faces. *a*. "Type a," A, C, E; "Type b," B, D, F. *b*. "Type c," A, C; "Type c'," B, D, E.

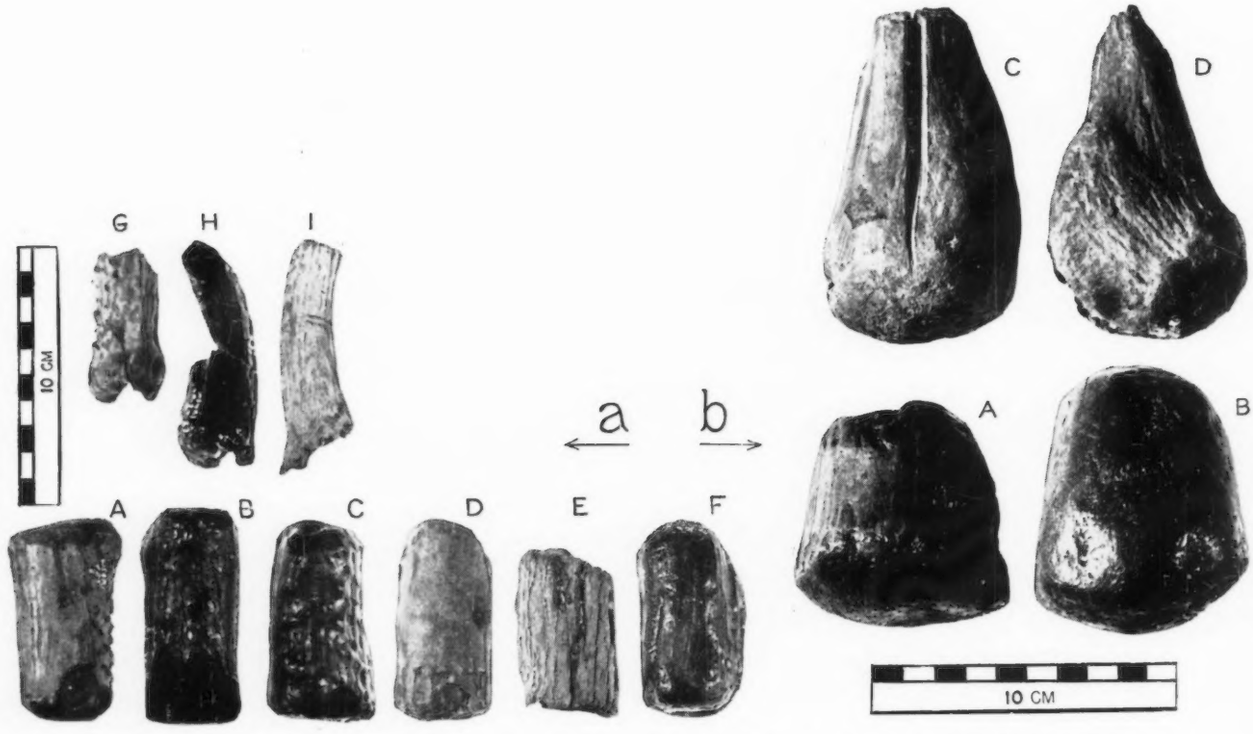


FIG. 39. Antler. *a*. Cylinders. "Type a," A–F; "Type b," G–H; "Type c" I. *b*. Pyriforms from beam bases. "Type a," short length, A–B; "Type b, elongated, C–D.

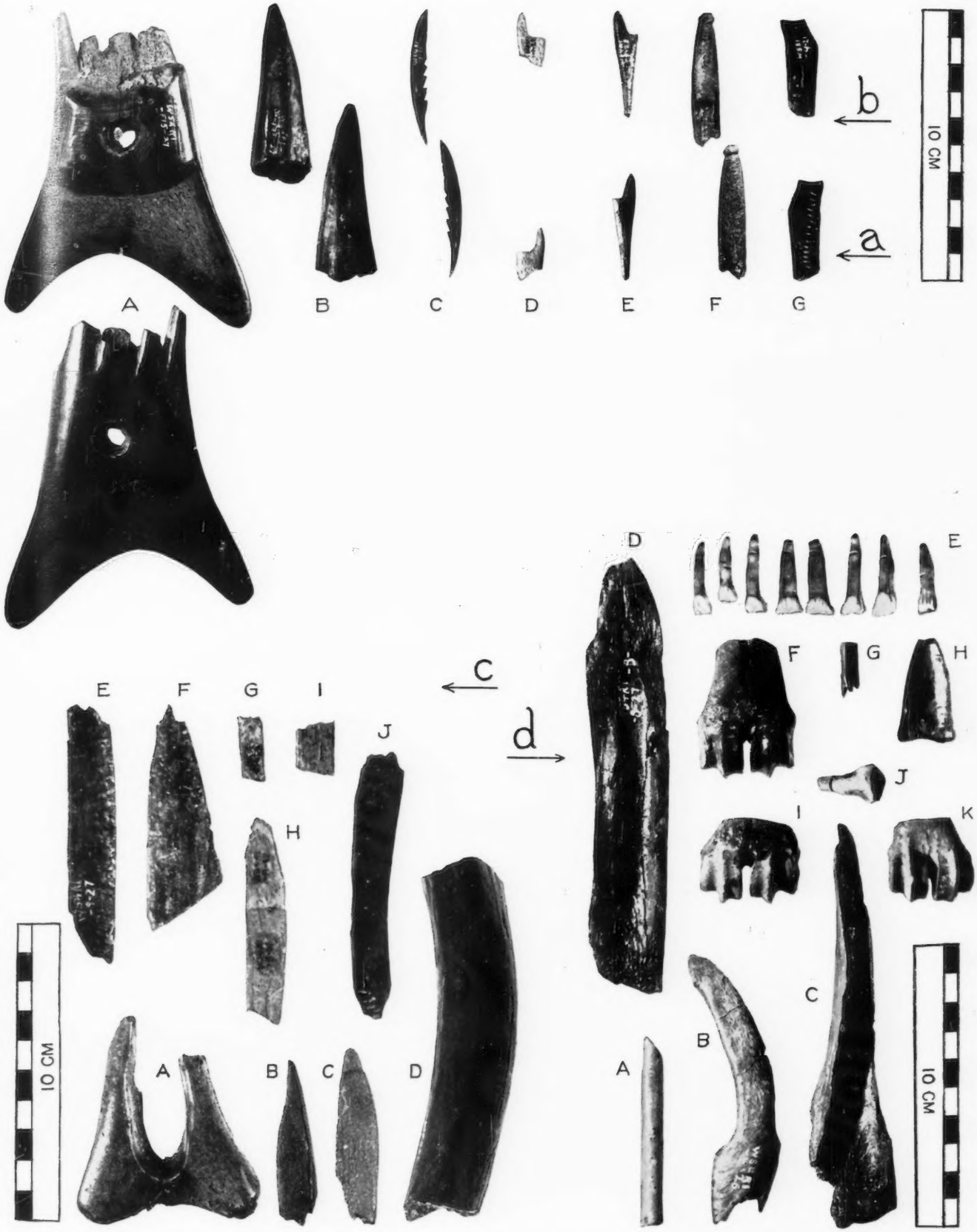


FIG. 40. Antler and bone, miscellaneous. *a*. A, use unknown; B, flaker; C, harpoon or harpoon prong; D–E, atlatl spurs; F, harpoon prong; G, bone fragment with transverse grooves. *b*. Reverse surfaces of *a*. *c*. Worked bone. *d*. Worked bone except E which consists of notched elk incisors.

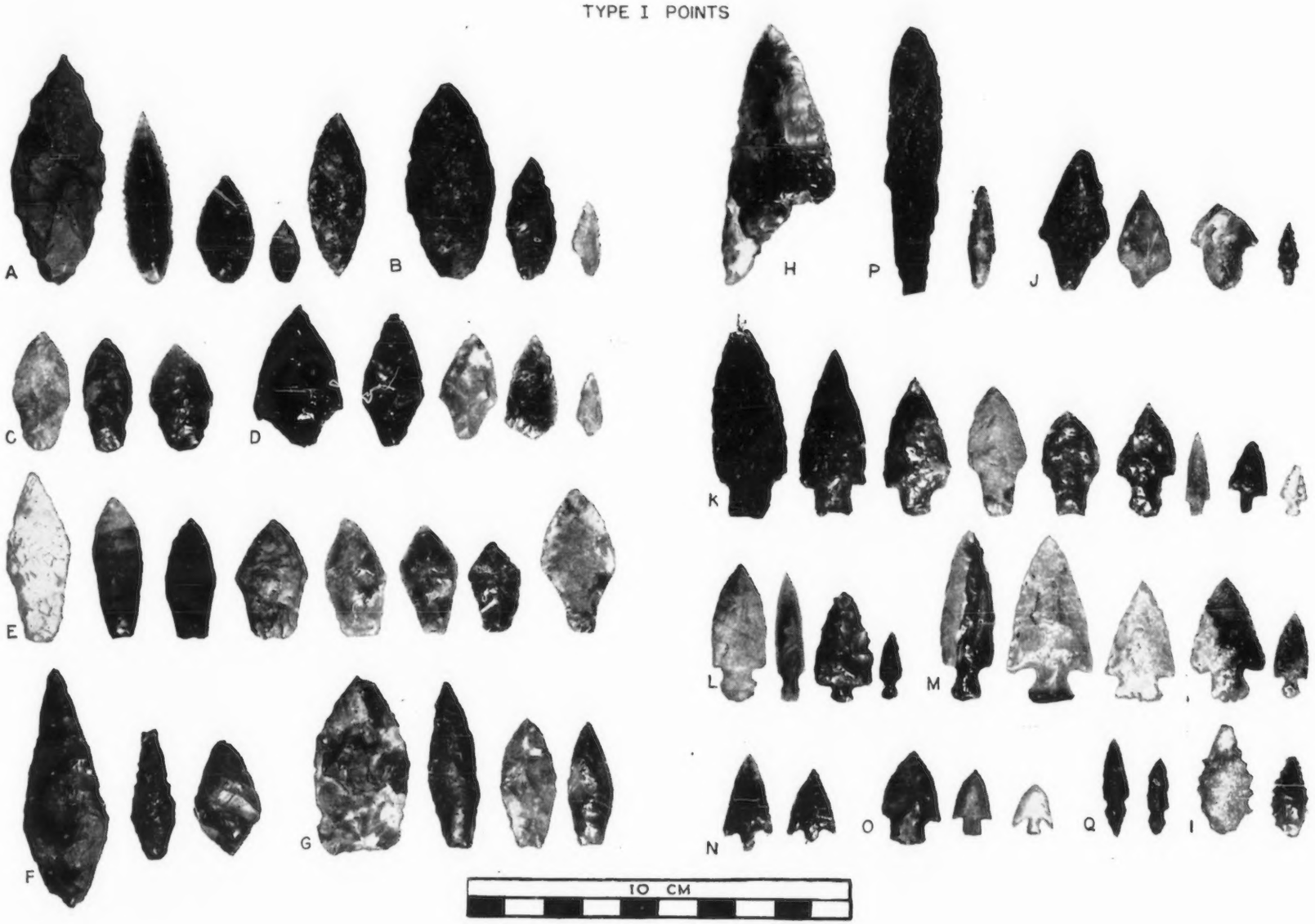


FIG. 41*a*. Projectile points Type I.

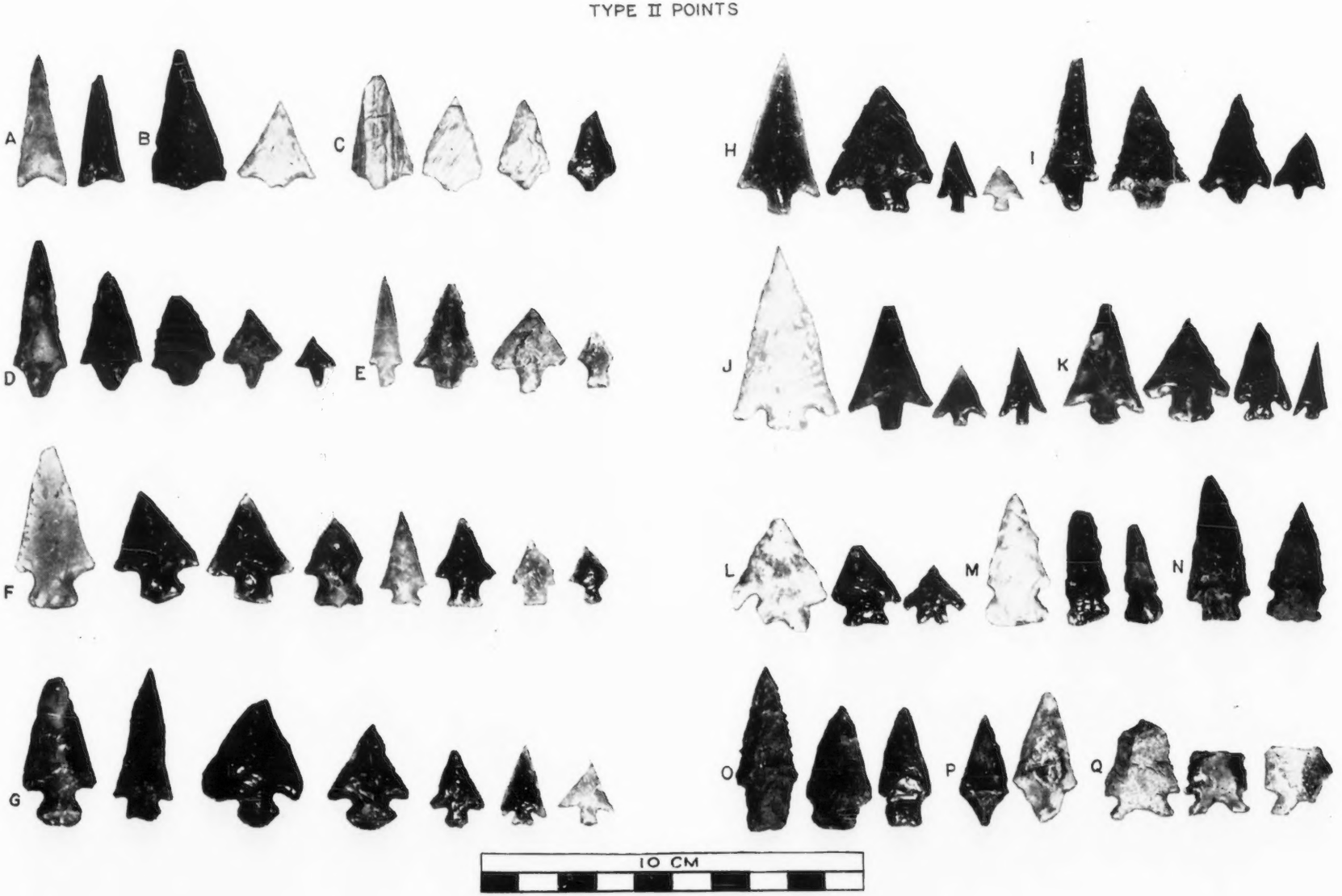


FIG. 41*b*. Projectile points Type II.

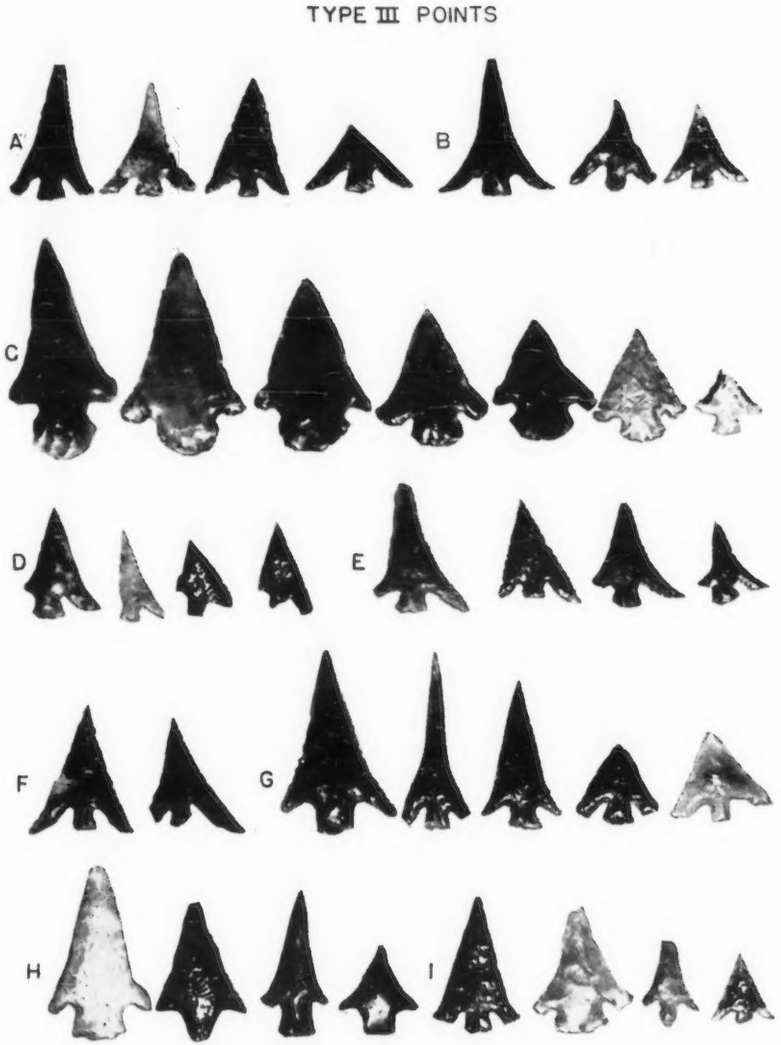


FIG. 41*c*. Projectile points Type III.

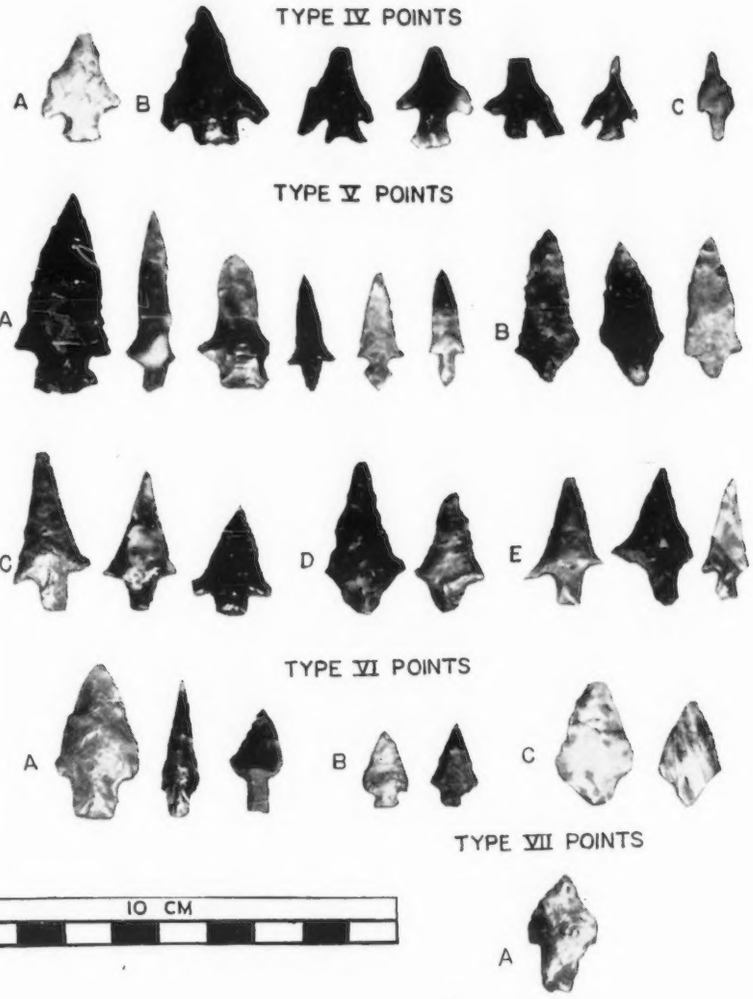


FIG. 41*d*. Projectile points Type IV–VII.

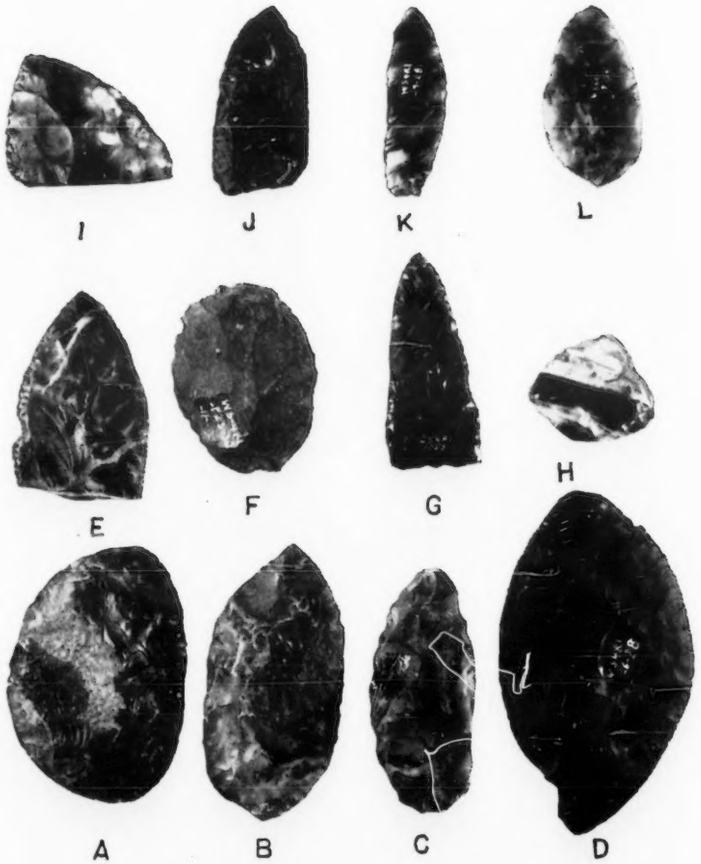


FIG. 42. Blades, Class A. A-Type 11. B-12. C and D-14. E-10. F-13. G-1. H-8. I-10. J-9. K-5. L-4.

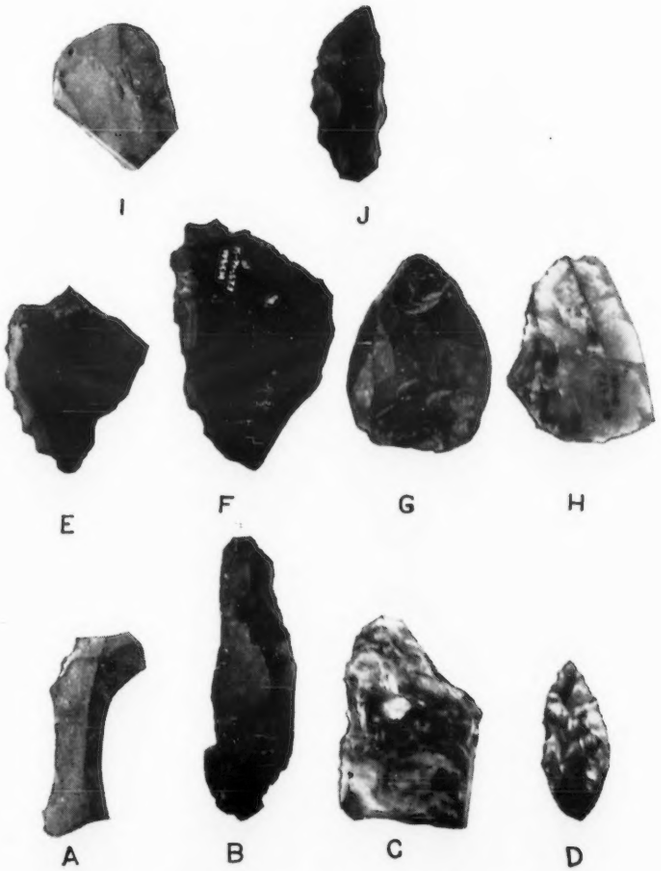


FIG. 43. Blades, Class B. A-Type 1. B-2. C-3. D-4. E-6. F-5. G-7. H-8. I-10. J-9.

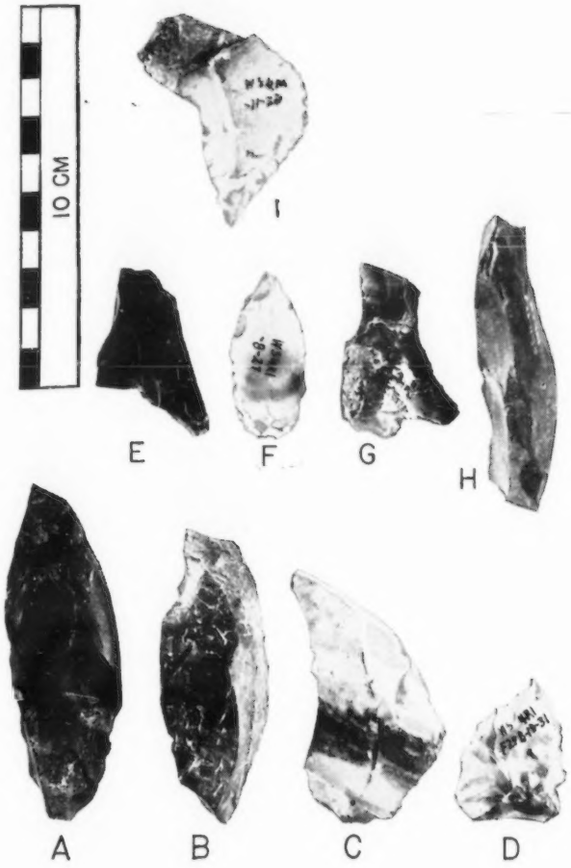


FIG. 44. Burins. A–D-Type 1; E–H-2; I-3.

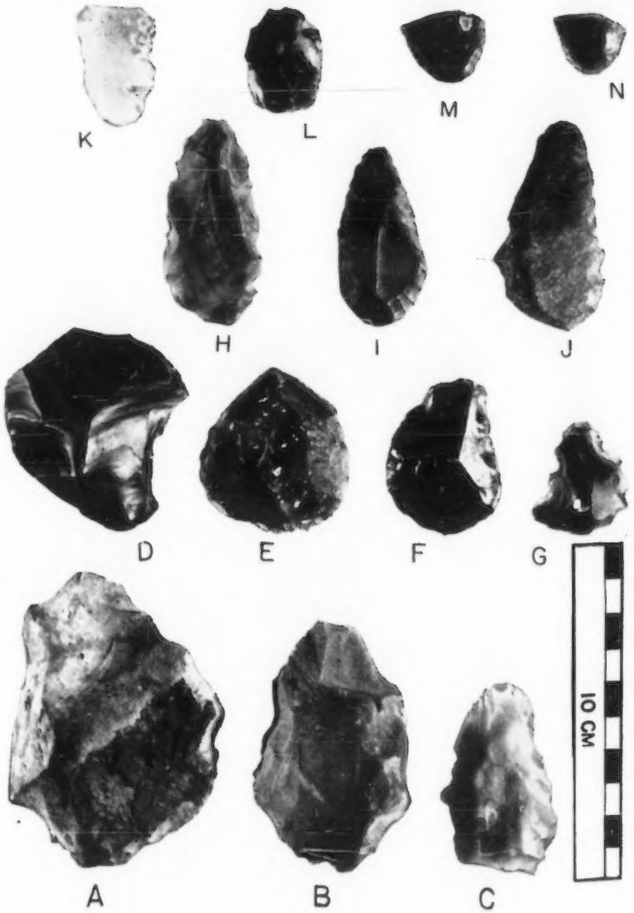


FIG. 45. Scrapers. A–C. Keeled chopper-scrapers. D–G. Keeled. H–J. Snub nosed. K–N. Thumb nail.

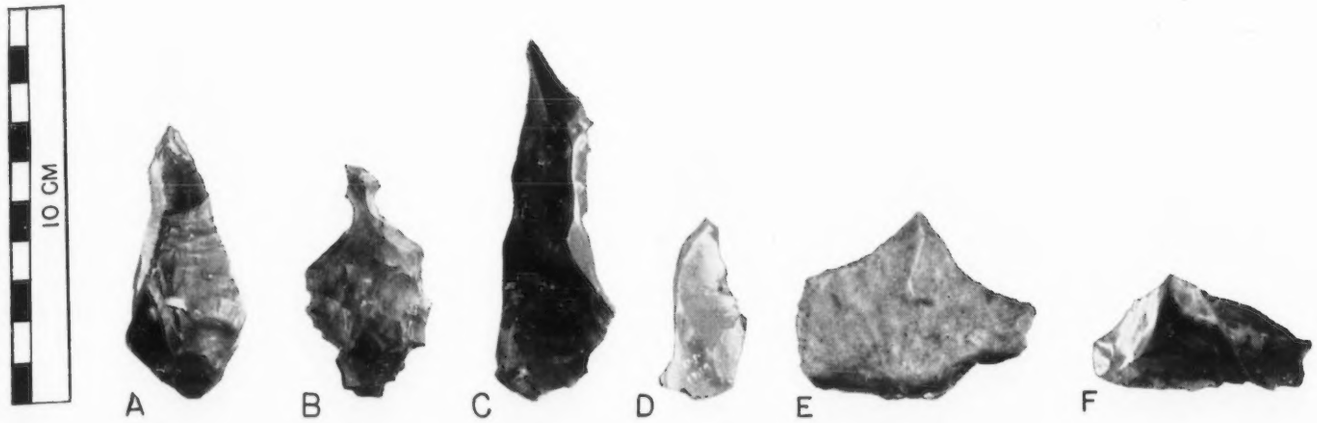


FIG. 46. Gravers. A–D. Type 13. E–F. Type 14.

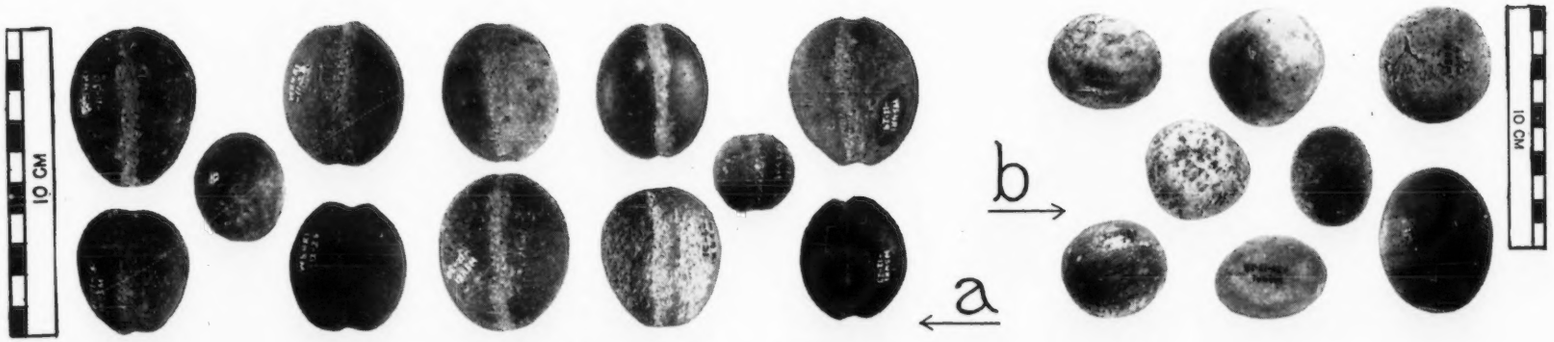


FIG. 47. Bolas. *a*. Girdled. *b*. Unmodified.

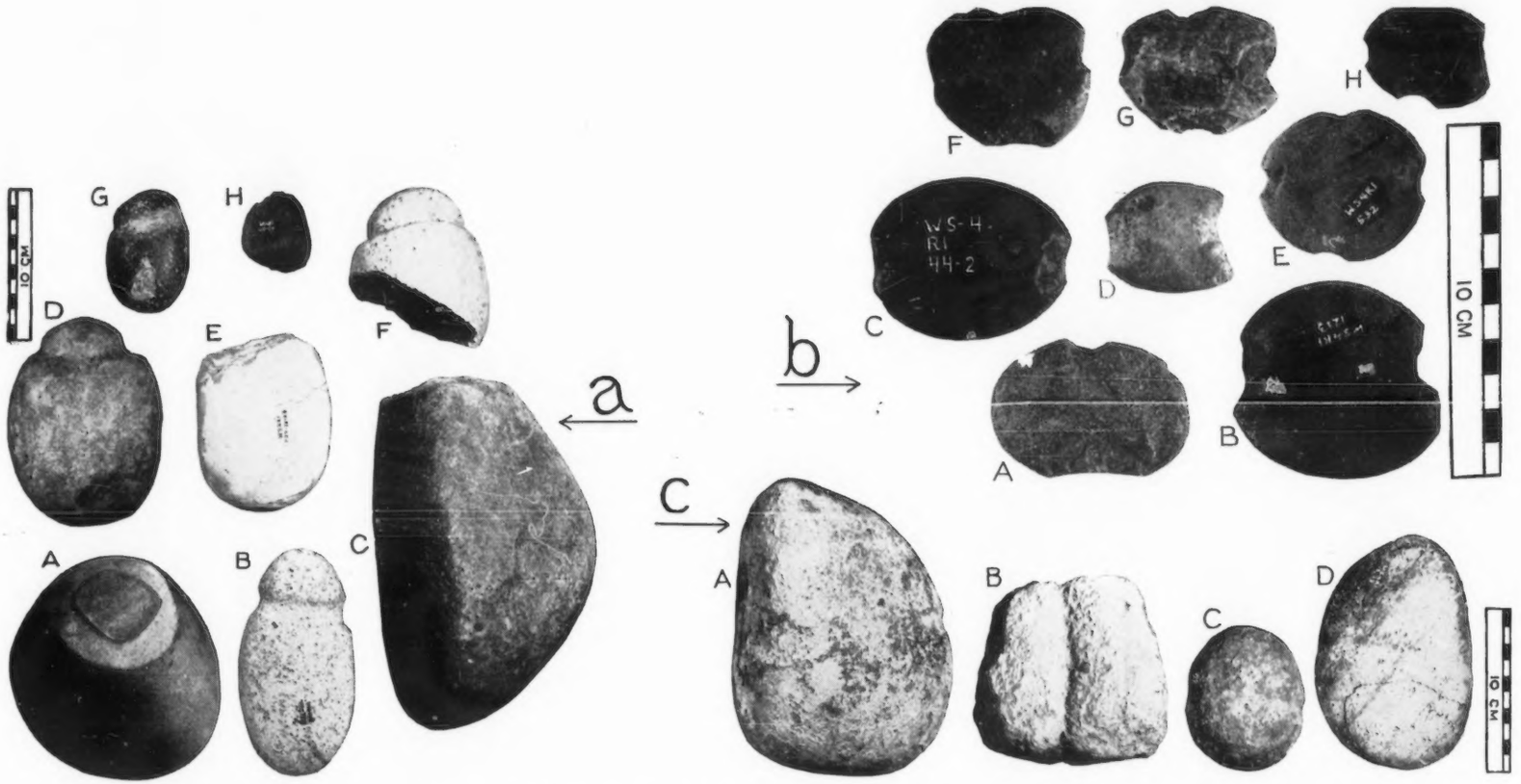


FIG. 48. Weights. *a*. Plumb bob type. *b*. Notched sinkers. *c*. Girdled.

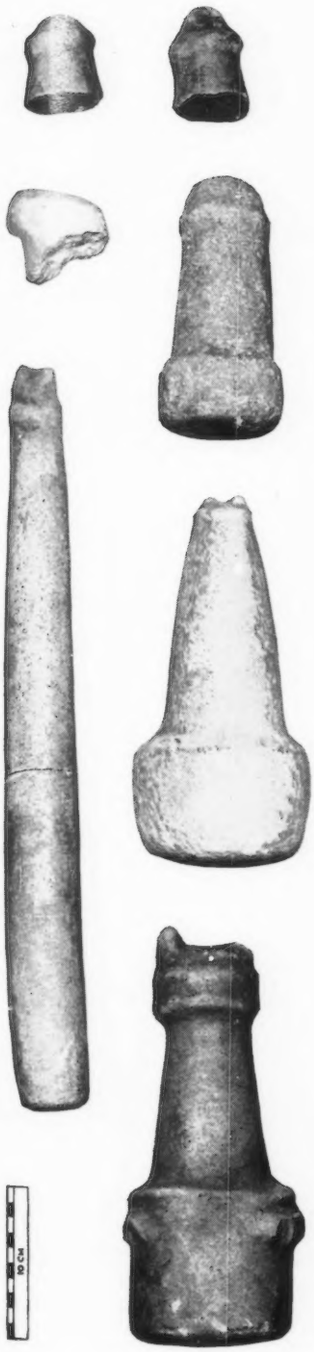


FIG. 49. Mauls and pestles.

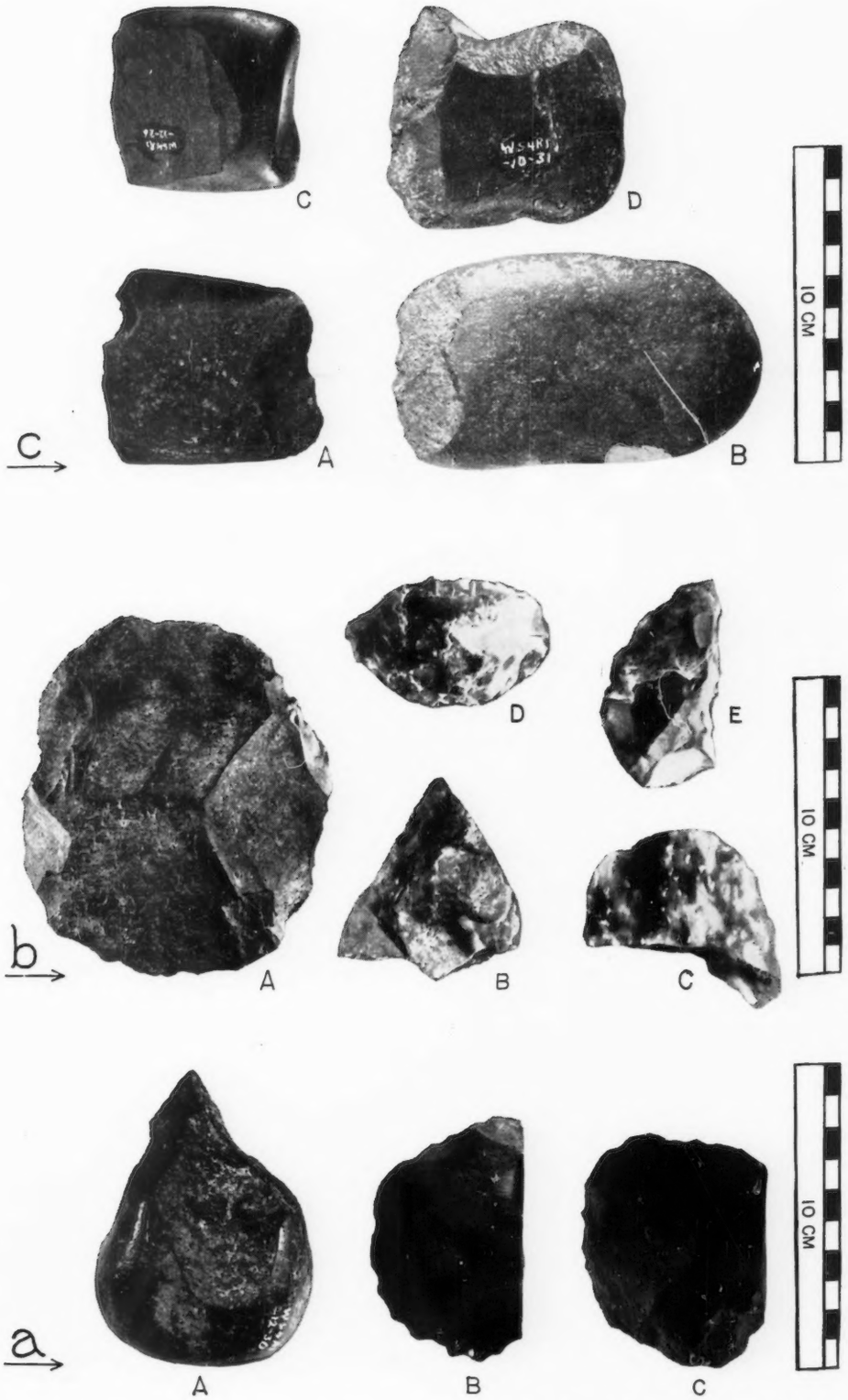


FIG. 50. Choppers. *a*. Pebble. *b*. Biface: A-Type 1, B-2, C-3, D-4, E-5. *c*. "Proto-adze."

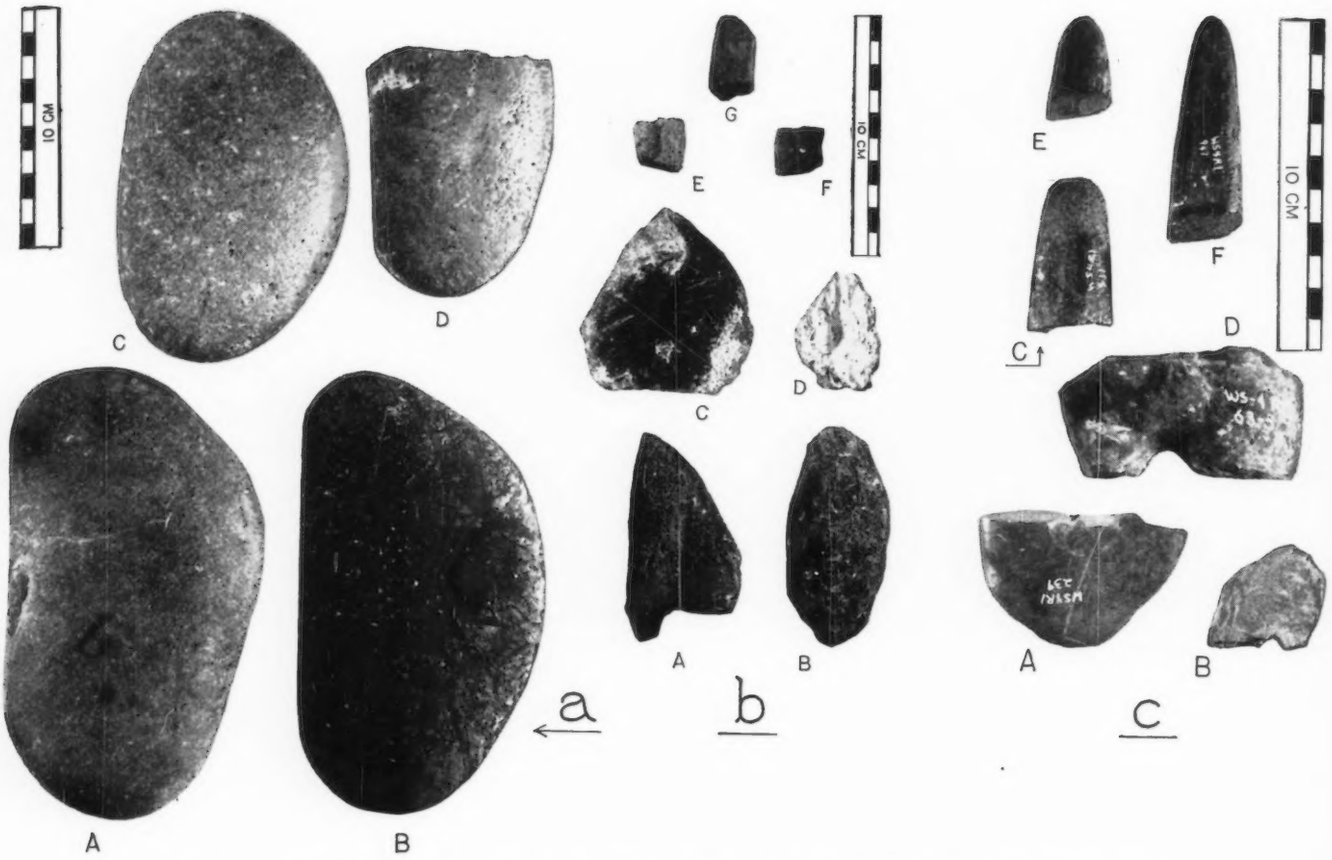


FIG. 51. Abrading and polishing stones. *a*. Side polishers. *b*. Miscellaneous, mostly scoriaceous basalt. *c*. Miscellaneous, mostly dense rock.

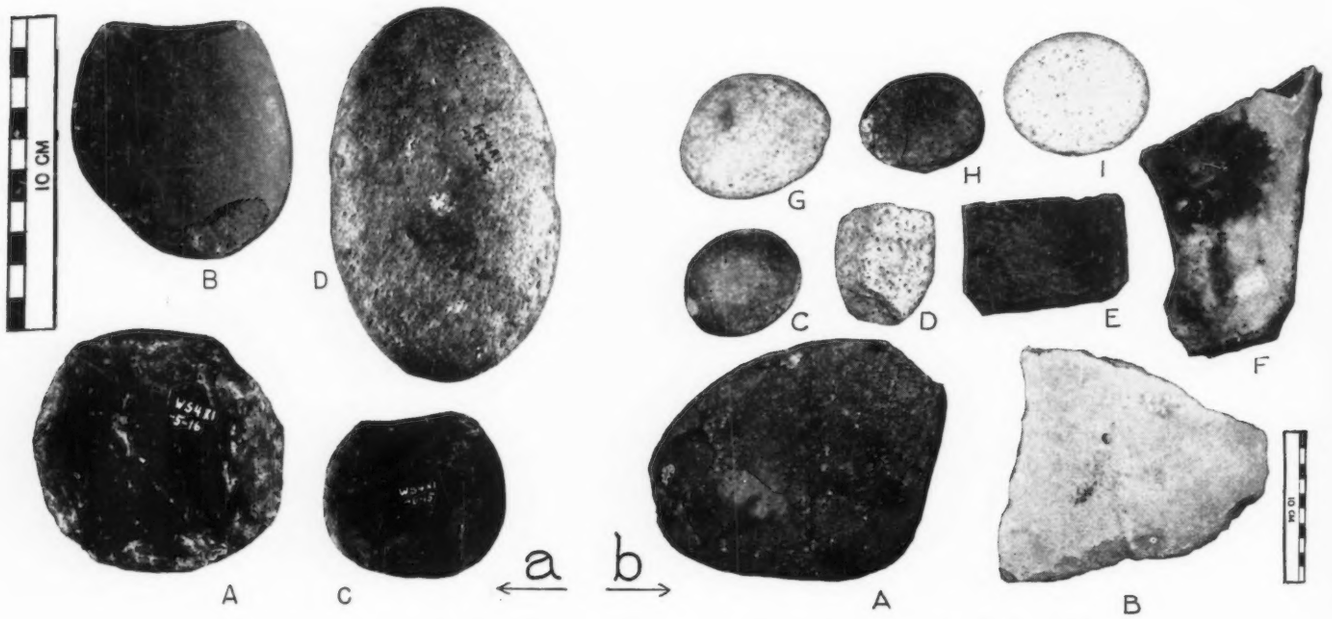


FIG. 52. Hammer and milling stones. *a*. Hammer stones. A–C, Type H6; D, Type H7. *b*. Milling stones. A–B, E–F, Metates; C–D, G–I, Manos.

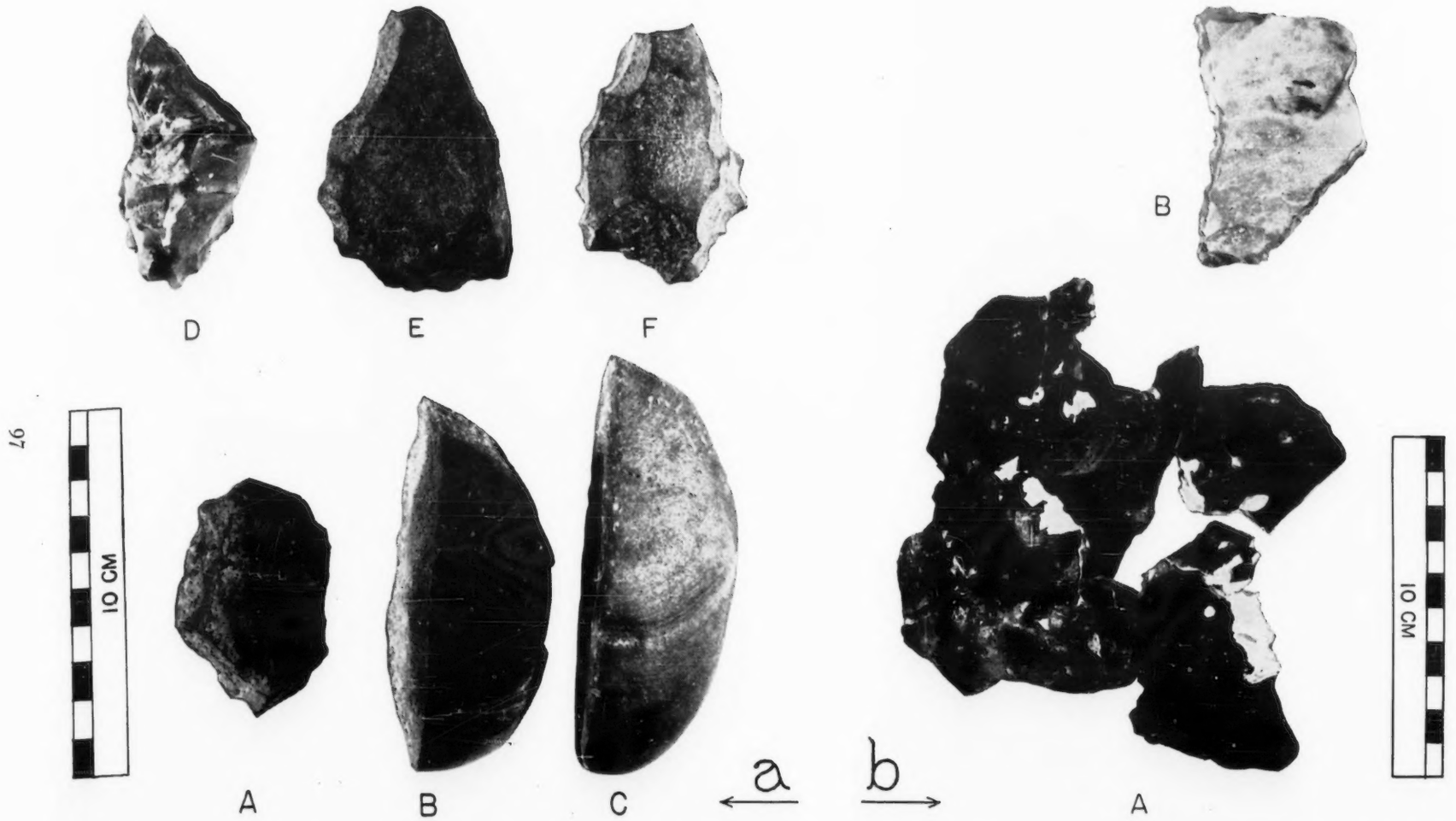


FIG. 53. Planes, flakes, and blade. *a*. Planes: B, C, F—Type 1. A, D, E—Type 2. *b*. A, cache of flakes. B, chalcedony bevelled edge scraper; both from Early level.

FIG. 54. Cache contents from Feature 29, Level 31. A–B2. Blade. B, C. Flake knives. D. Side scraper. E Awl. F. Bifacially flaked knife. G. Burin Type 1. H. Otter mandible. Unlettered. Obsidian flakes..

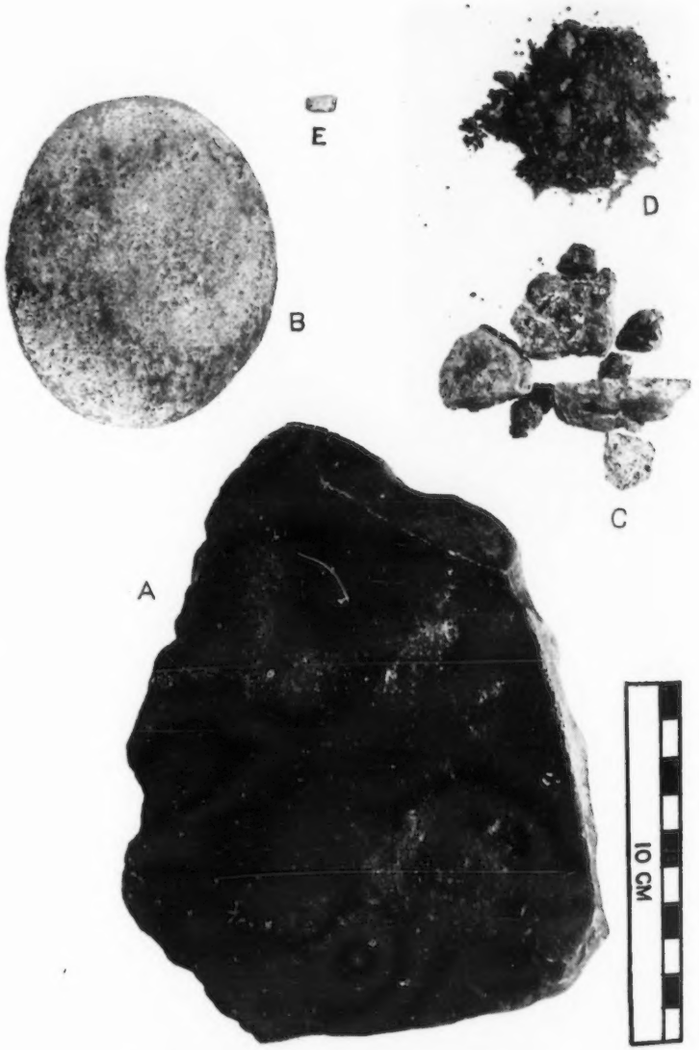


FIG. 55. Ochre and ochre milling stones. C. Raw ochre. D. Crushed ochre; others are milling stones.

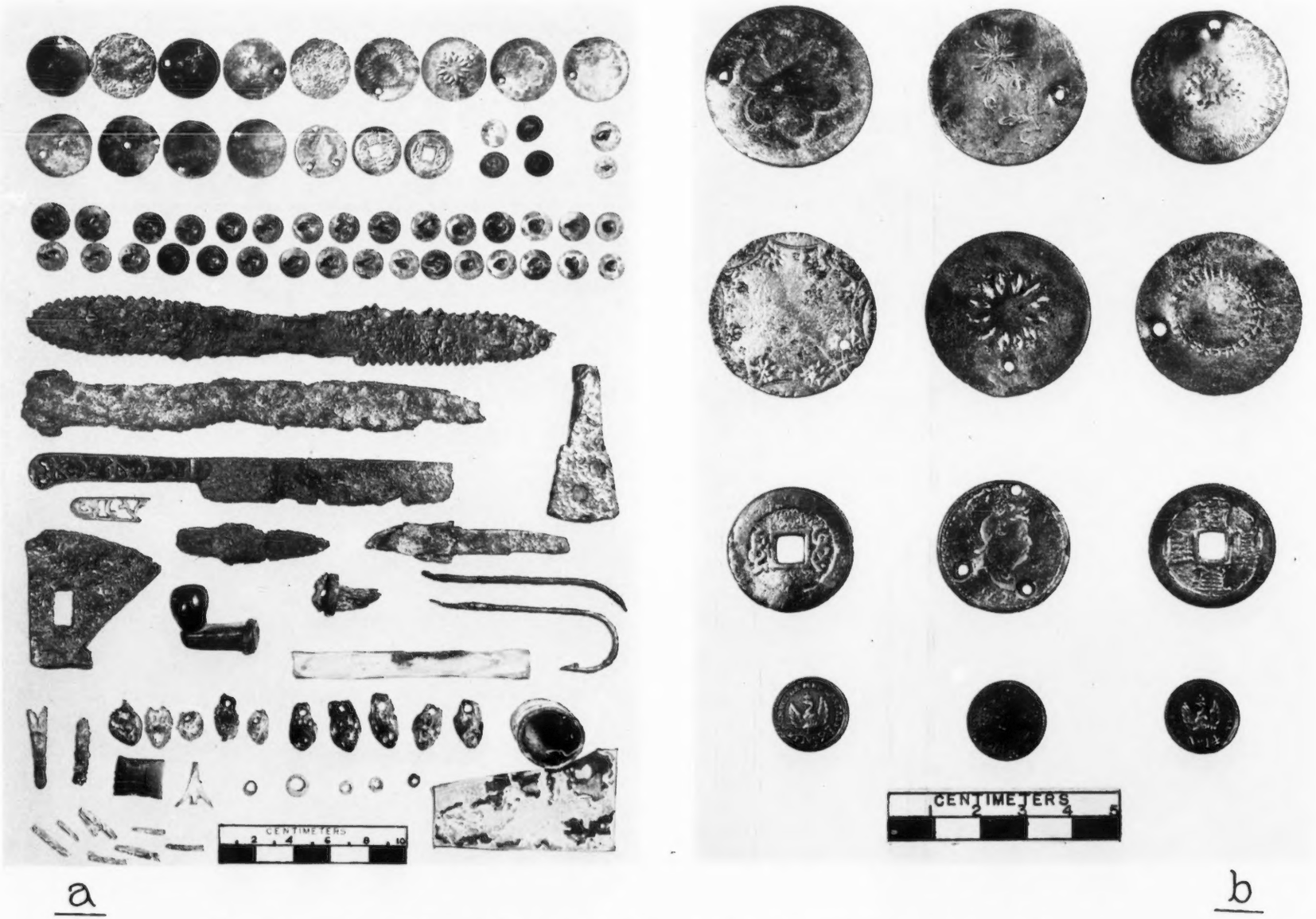


FIG. 56. Grave goods, *cf.* Appendix B. *a.* Sample of series. *b.* Selected "buttons" from upper two rows in *a.*

FIG. 57. Miscellaneous late artifacts. "Atlatl weight" (?), clay pipe, carved bone, pipes (donated by Emory Strong), pendants, beads, amulet (?).

FIG. 58. Alaskan-Aleutian artifacts. Sinkers, identified as such from Nikolski; carved stone from Alaska.

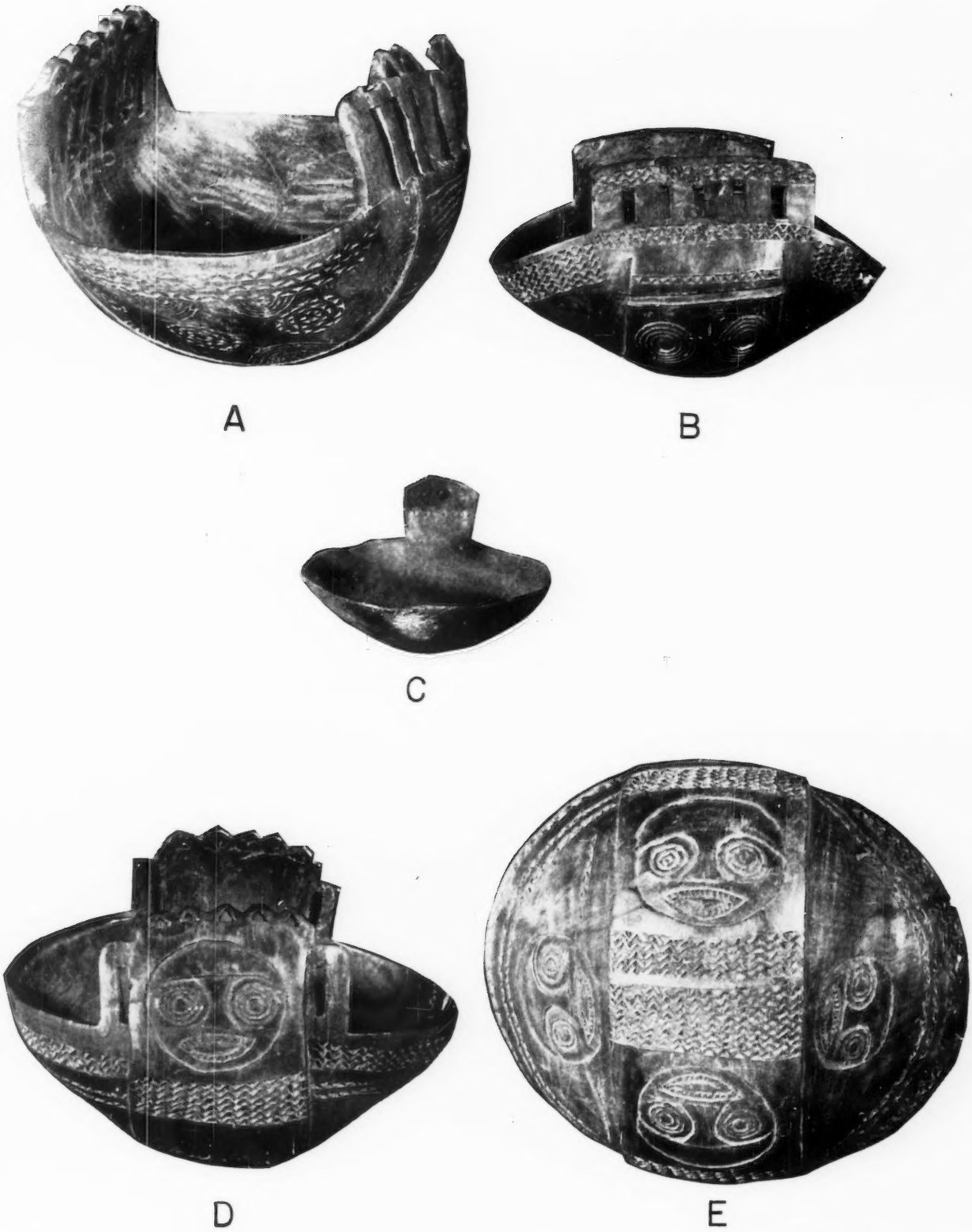
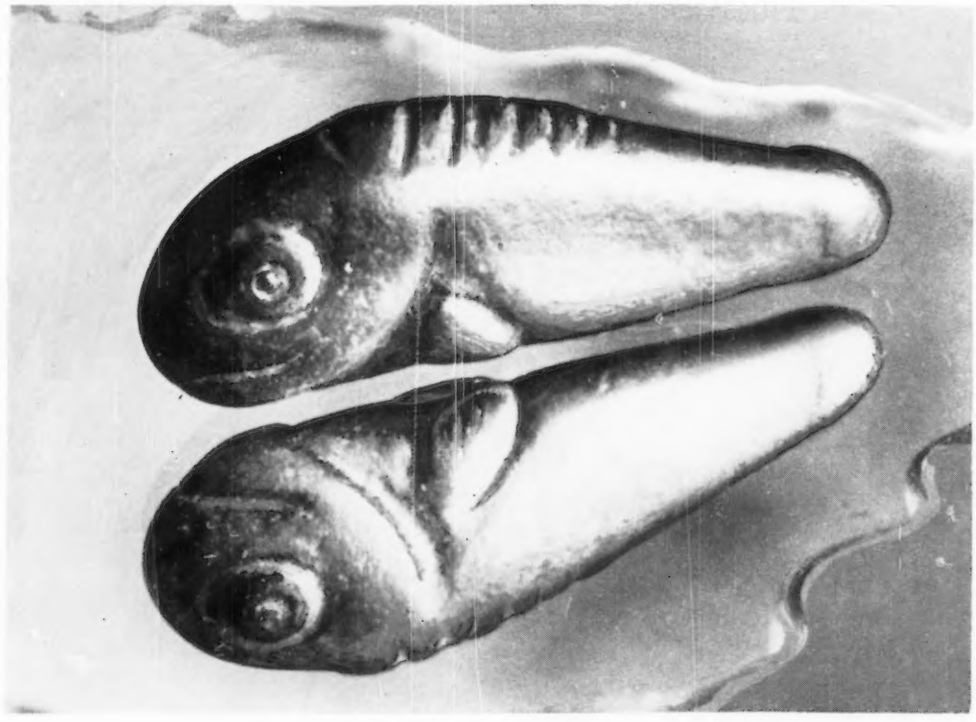


FIG. 59. Carved mountain sheep horn bowls and spoon. A. Length 193 mm., width 164 mm., thickness 6 mm. B. Length 216 mm., width at rim 123 mm., at mid height 142 mm., thickness 7 mm. C. Length 155 mm., width 135 mm., length of handle 40 mm., thickness 3 mm. D. Length 183 mm., width 156 mm., thickness 5 mm. E. Detail of bottom of D.



a.

b.

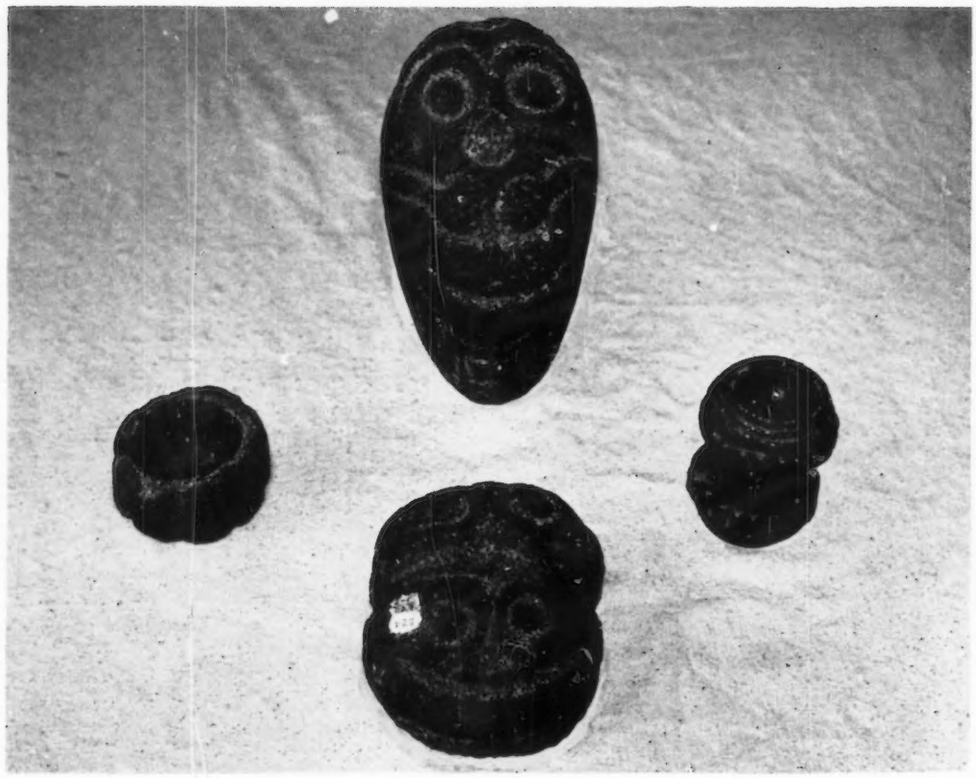
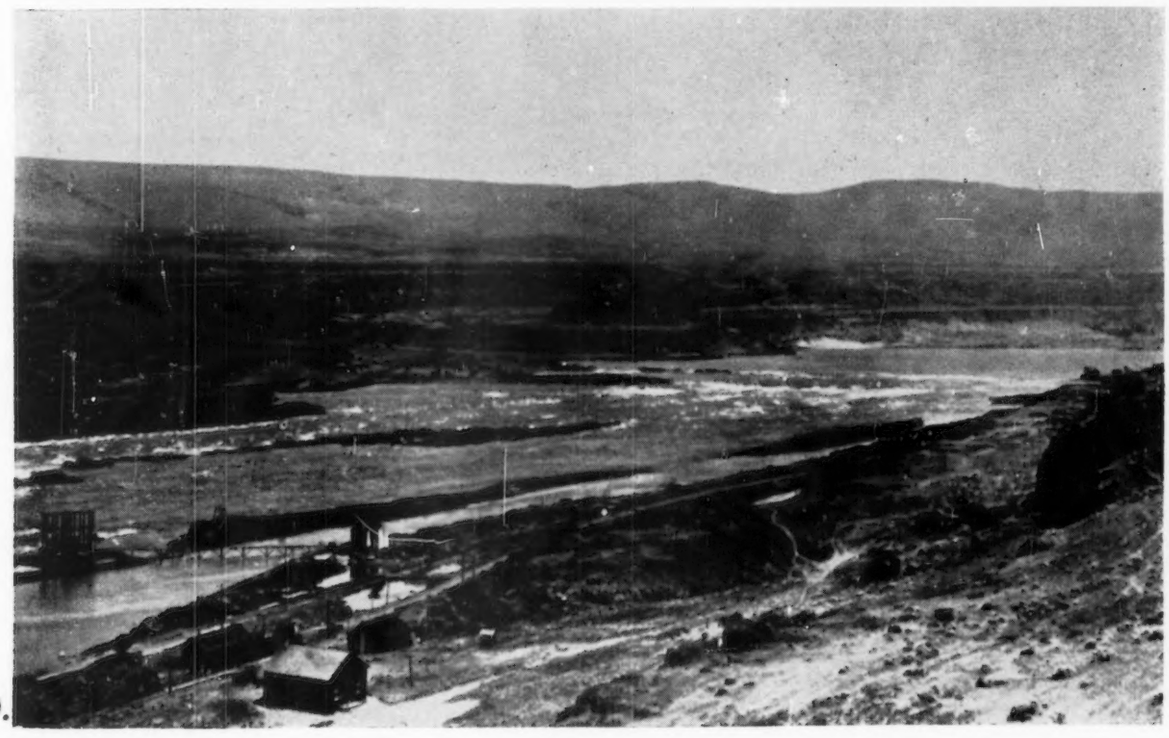


FIG. 60. Stone sculpture from The Dalles region. *a*. Salmon, length 7.3 cm., photographed on mirror. *b*. Carved tools, height of double bowl 10.2 cm.

a.



b.

FIG. 61. Construction use of archaeological sites, 1912–1915, showing various stages of construction in the archaeological area and resulting disturbance of the surface. *a*. WS-1. *b*. WS-4 Roadcut. Original photos courtesy of Mr. Ernest C. White, Corps of Engineers, The Dalles, Oregon. Copied from old prints, since negatives were unavailable.

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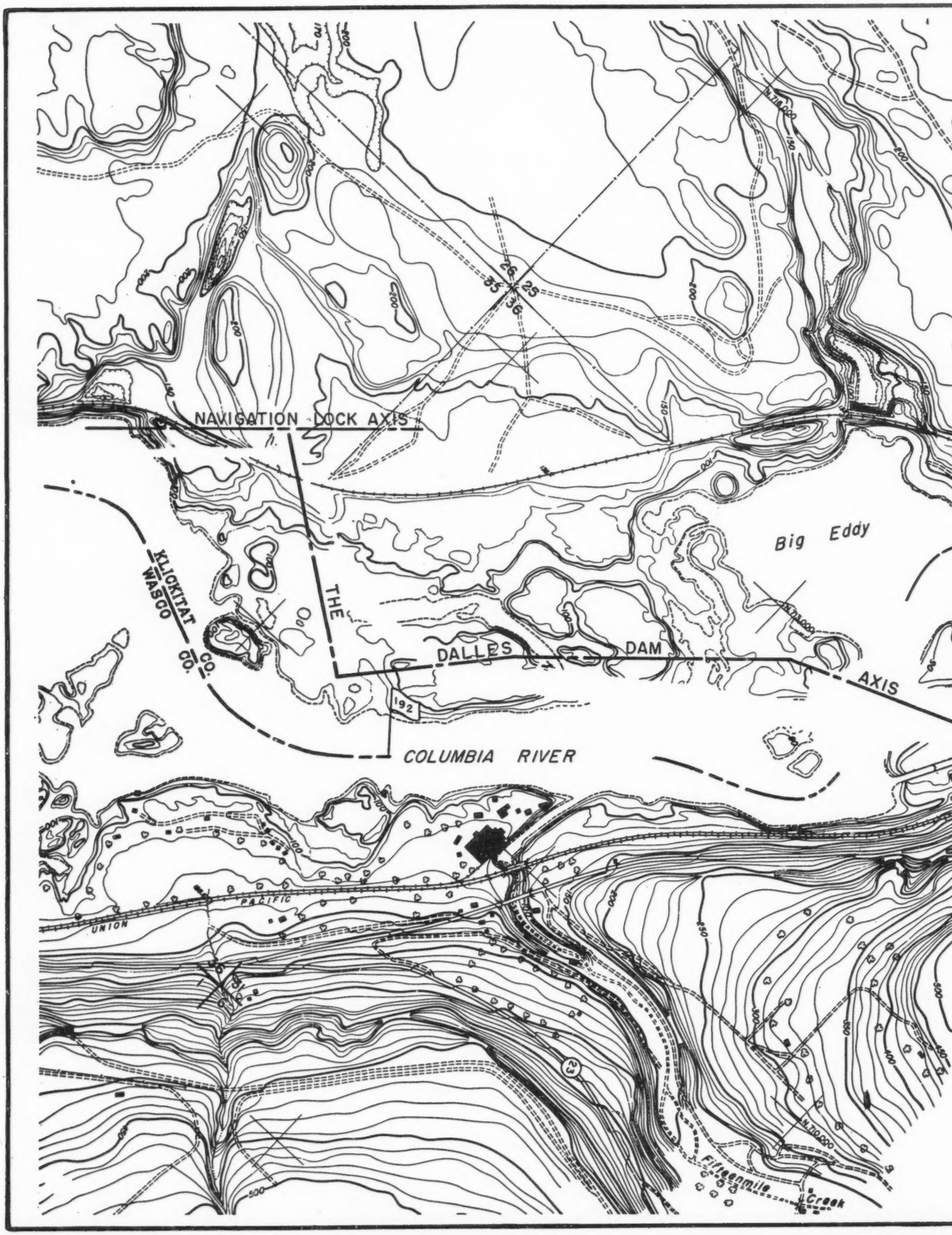

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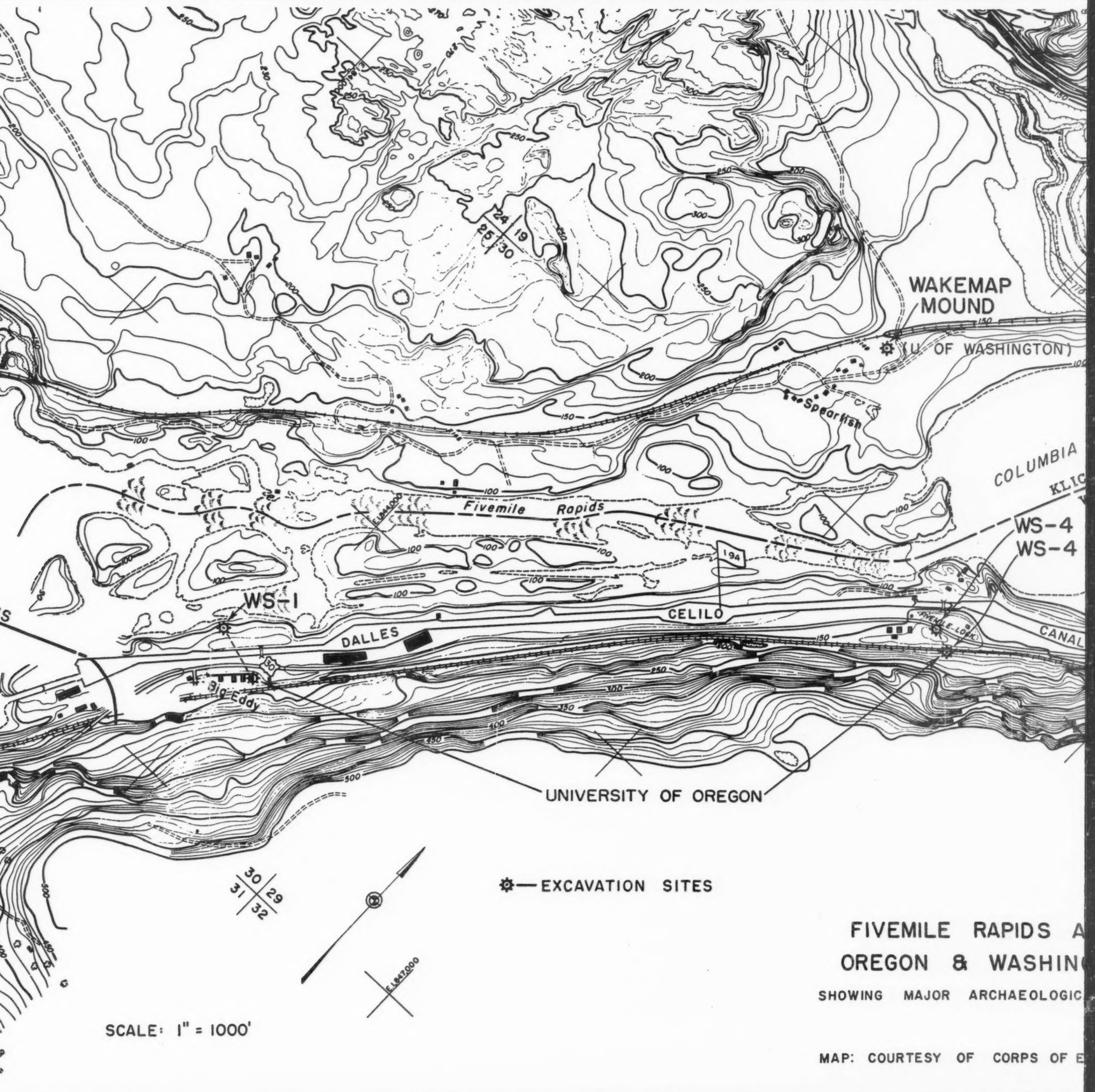

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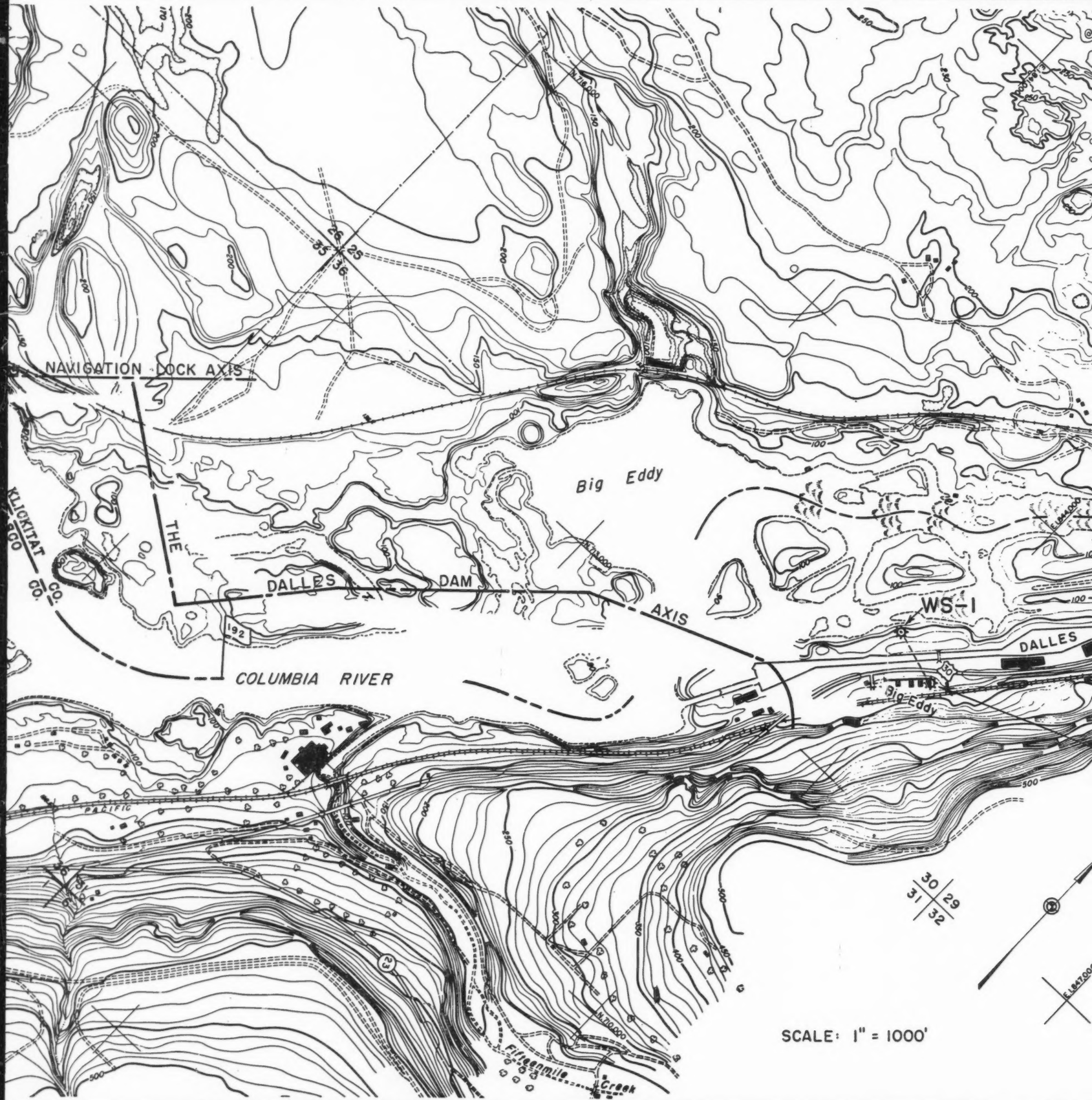

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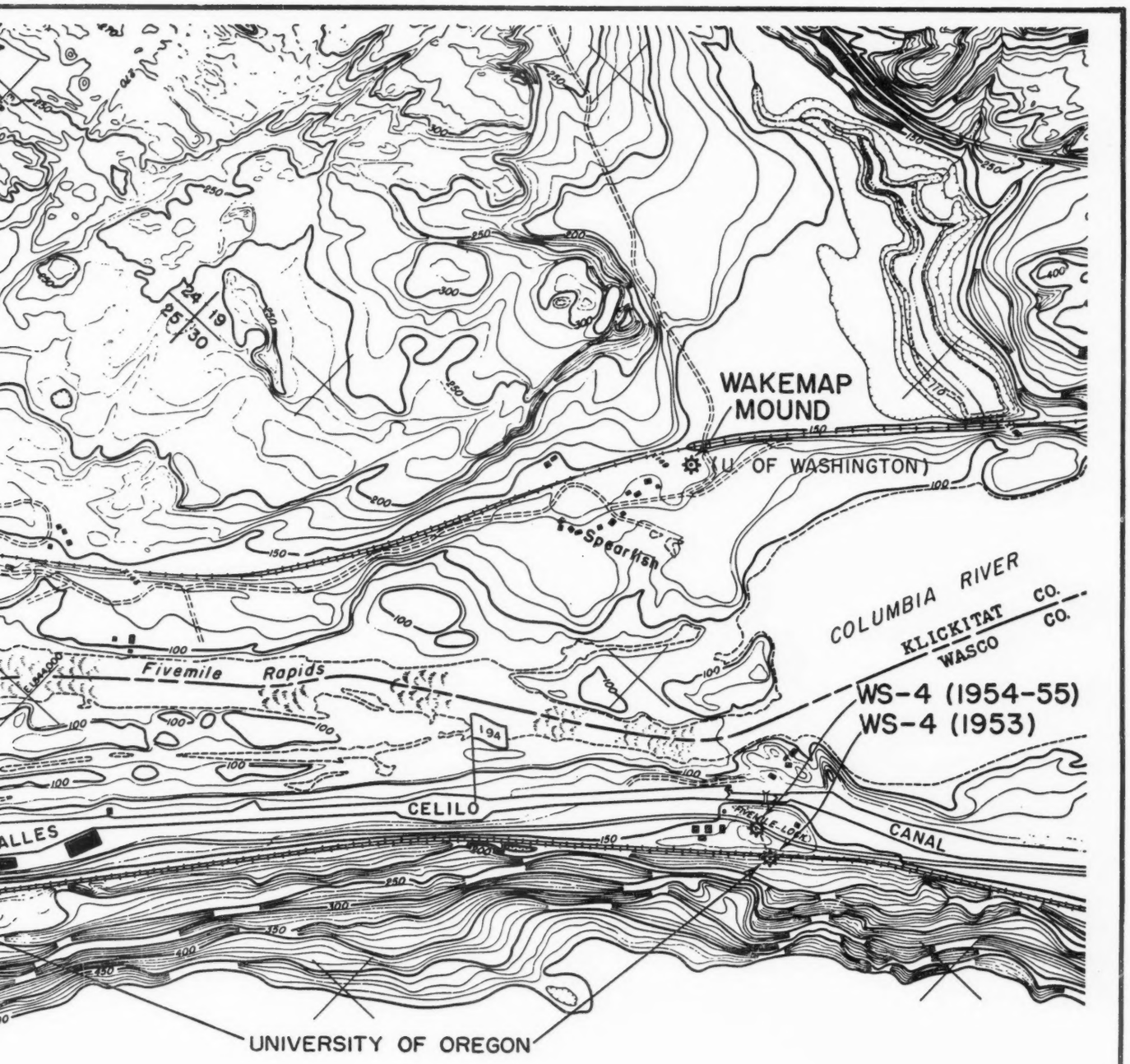

⚙— EXCAVATION SITES

FIVEMILE RAPIDS AREA
OREGON & WASHINGTON

SHOWING MAJOR ARCHAEOLOGICAL SITES

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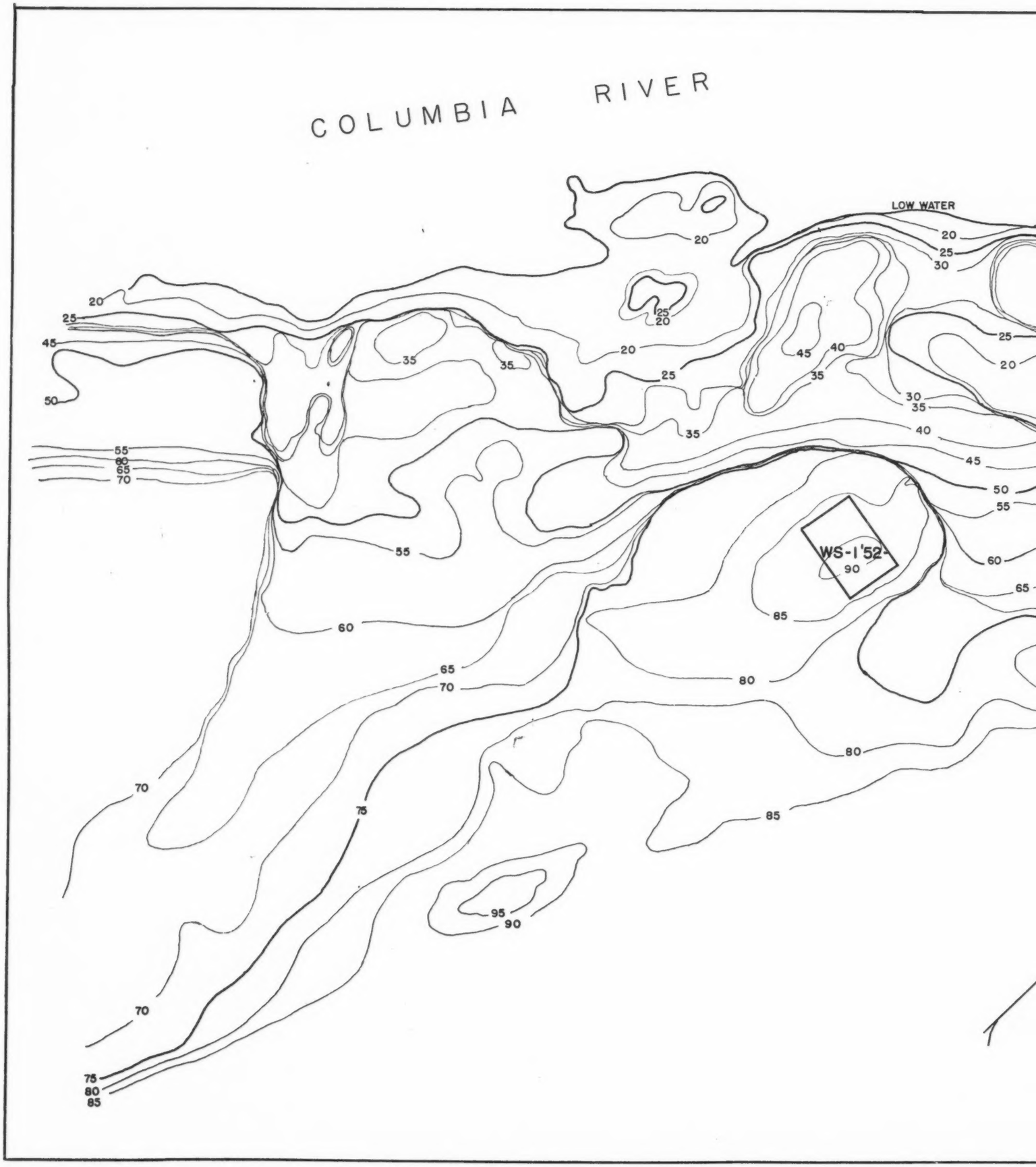

MAP 4.* P

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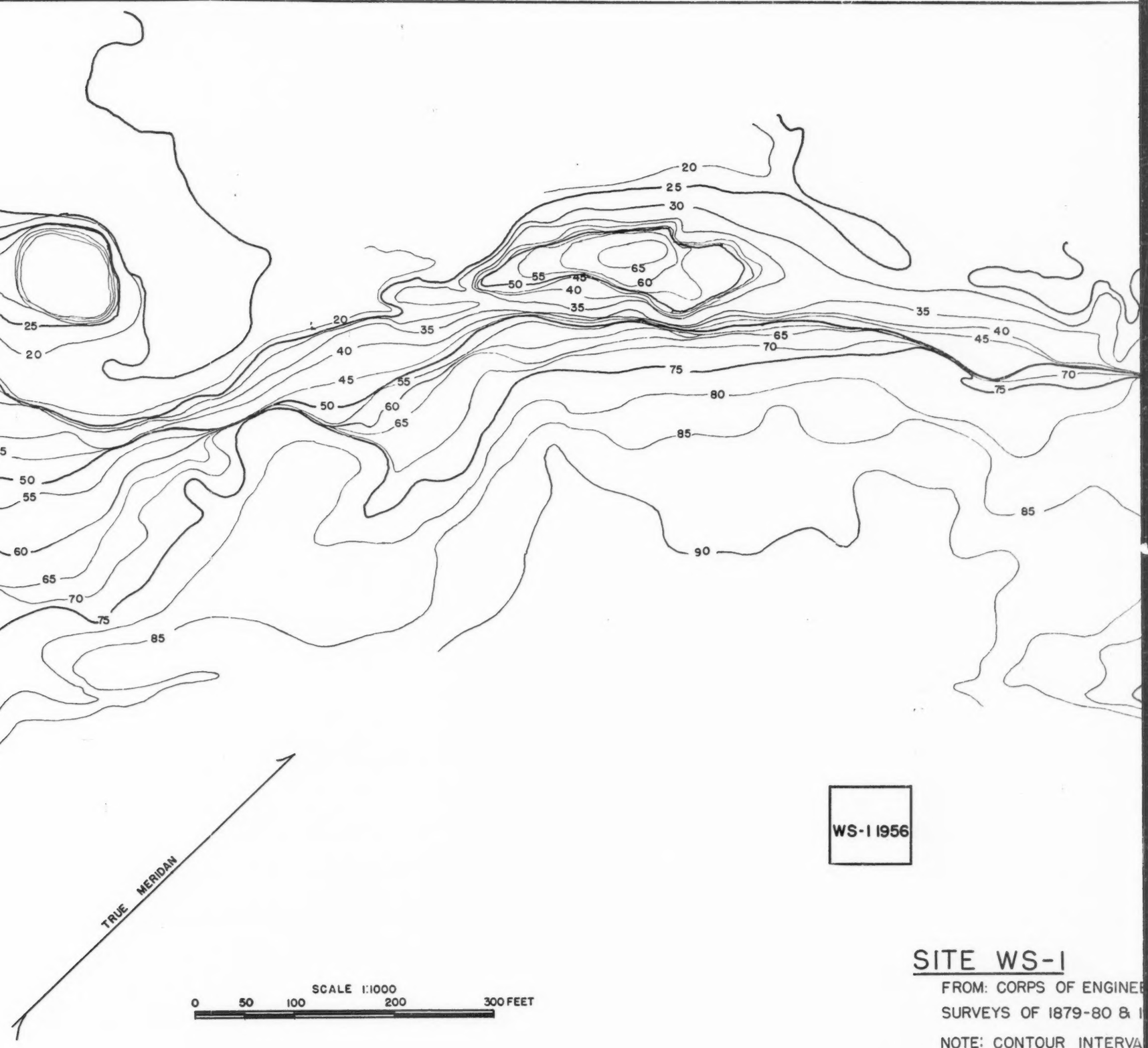
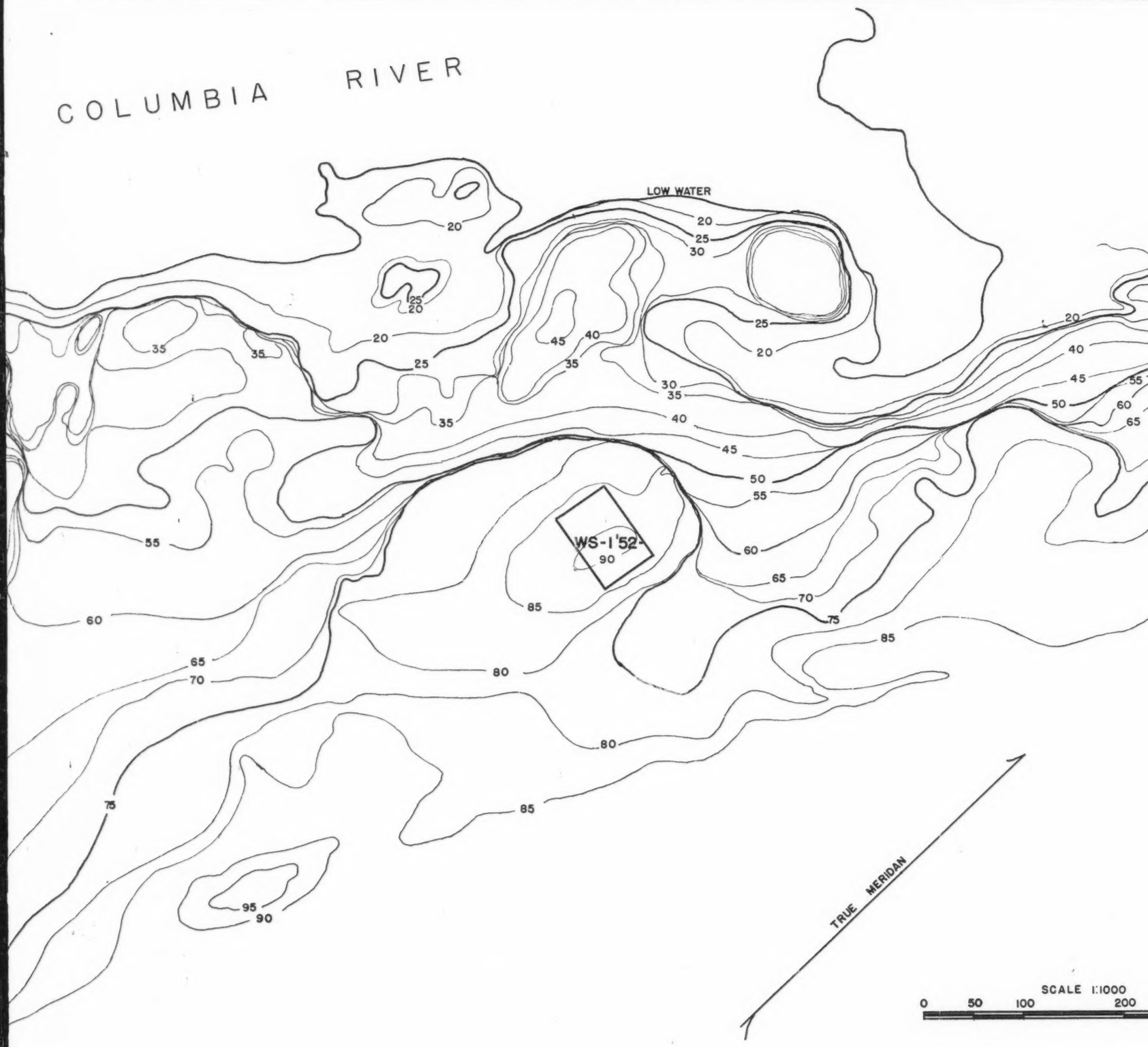


MAP 4.* Big Eddy area, partial, 1902–1903, showing excavation sites.



MAP 4.* Big Eddy area, partial, 1902–1903, showing excavation sites

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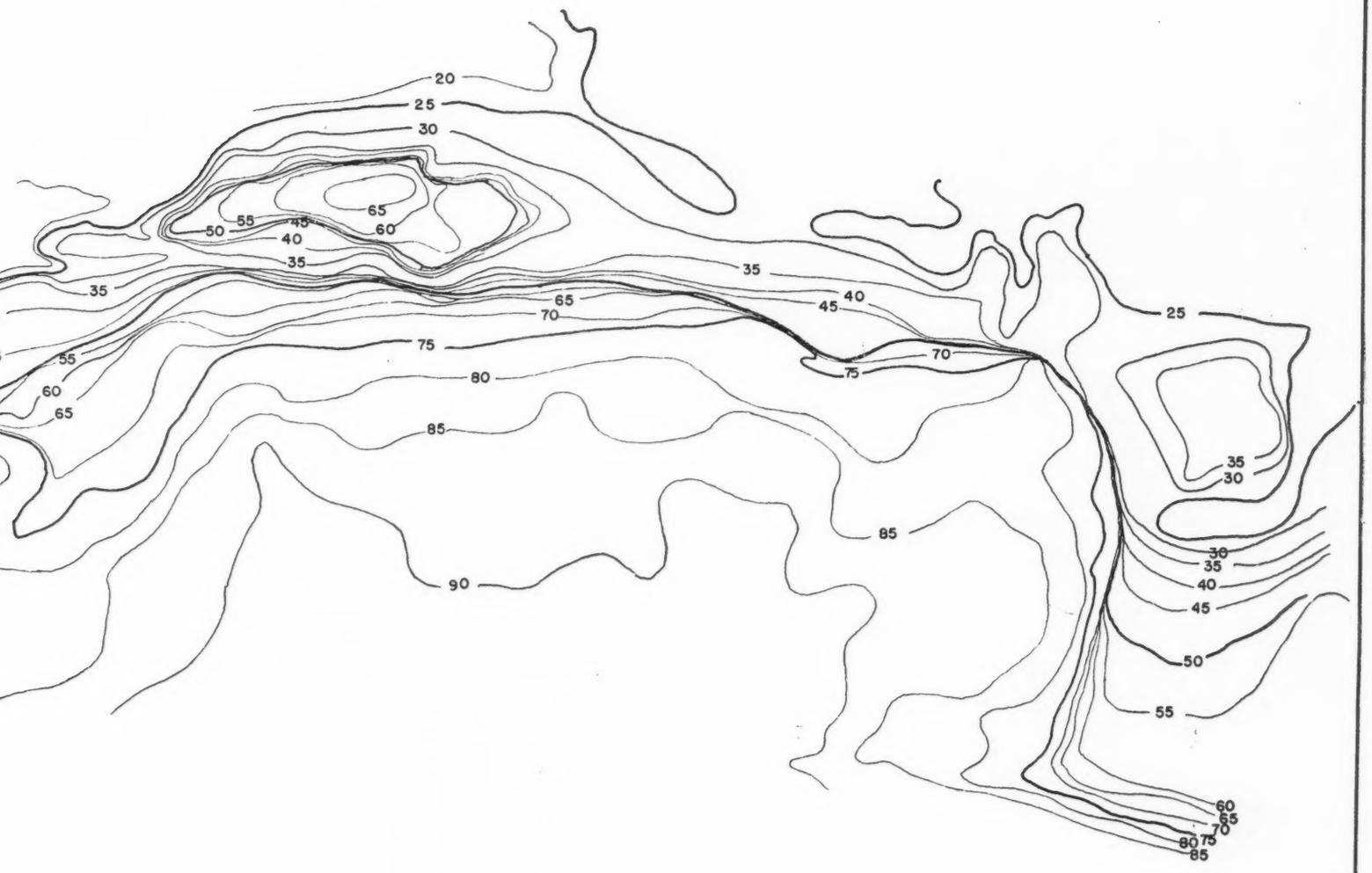

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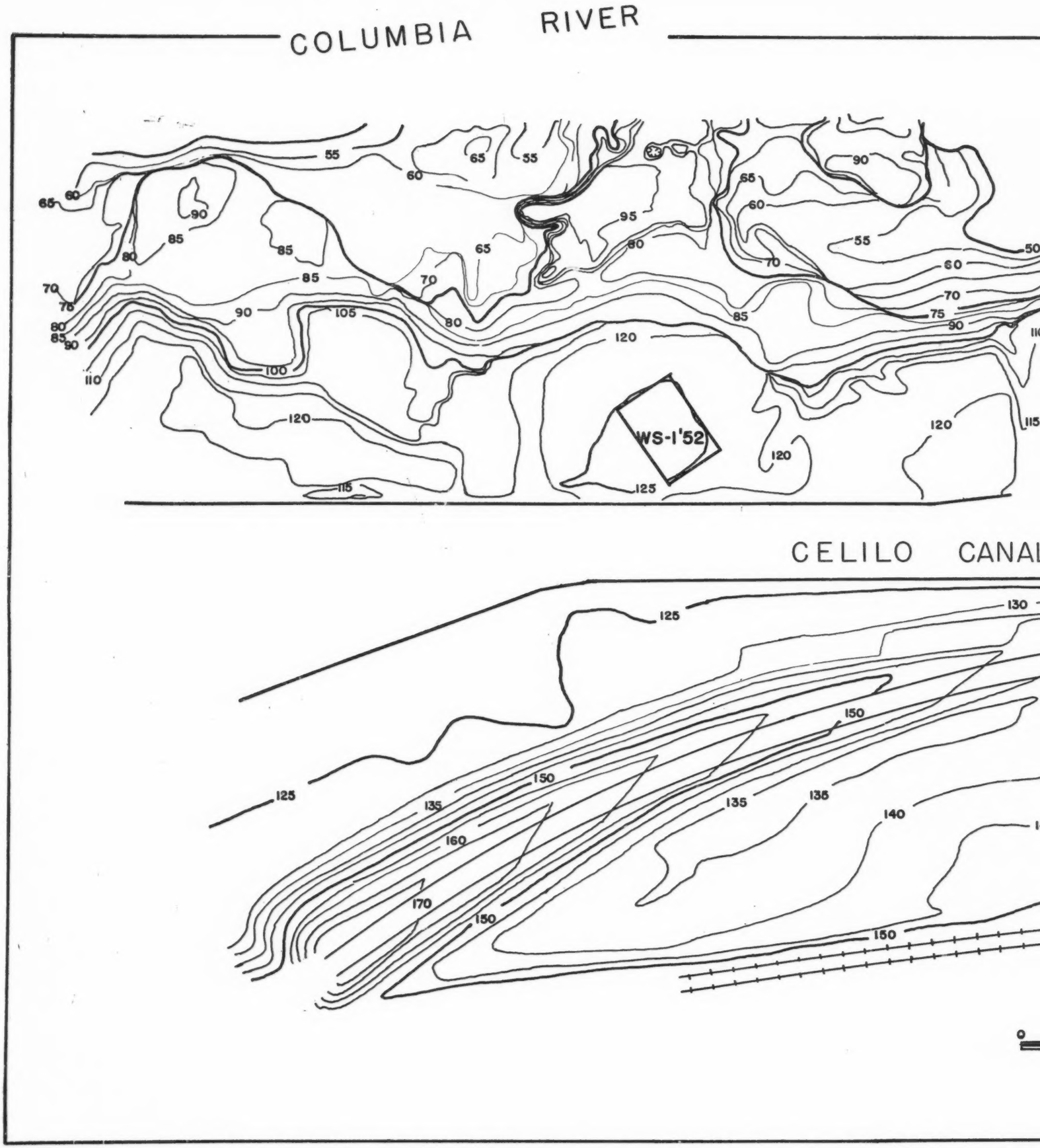

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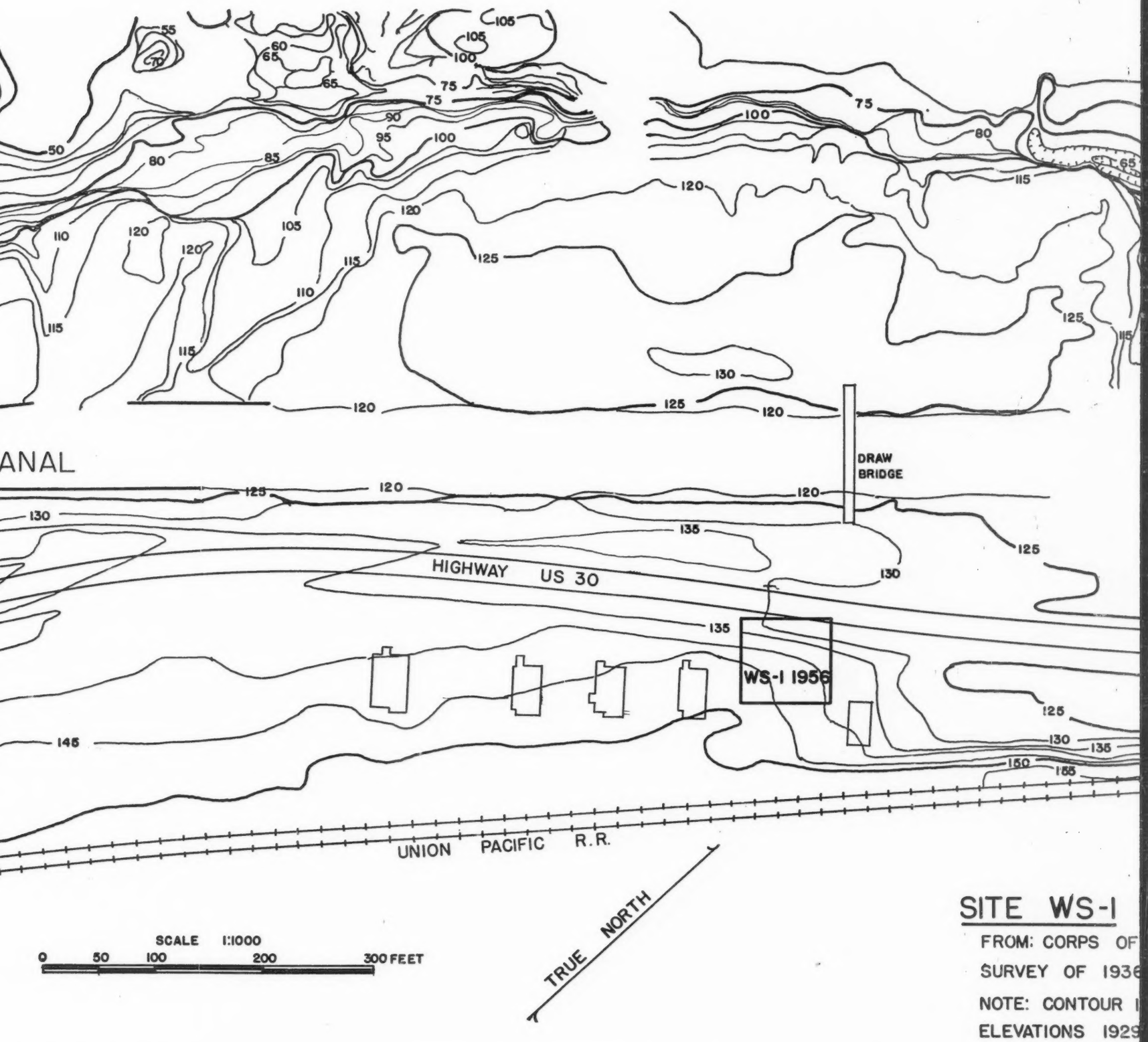
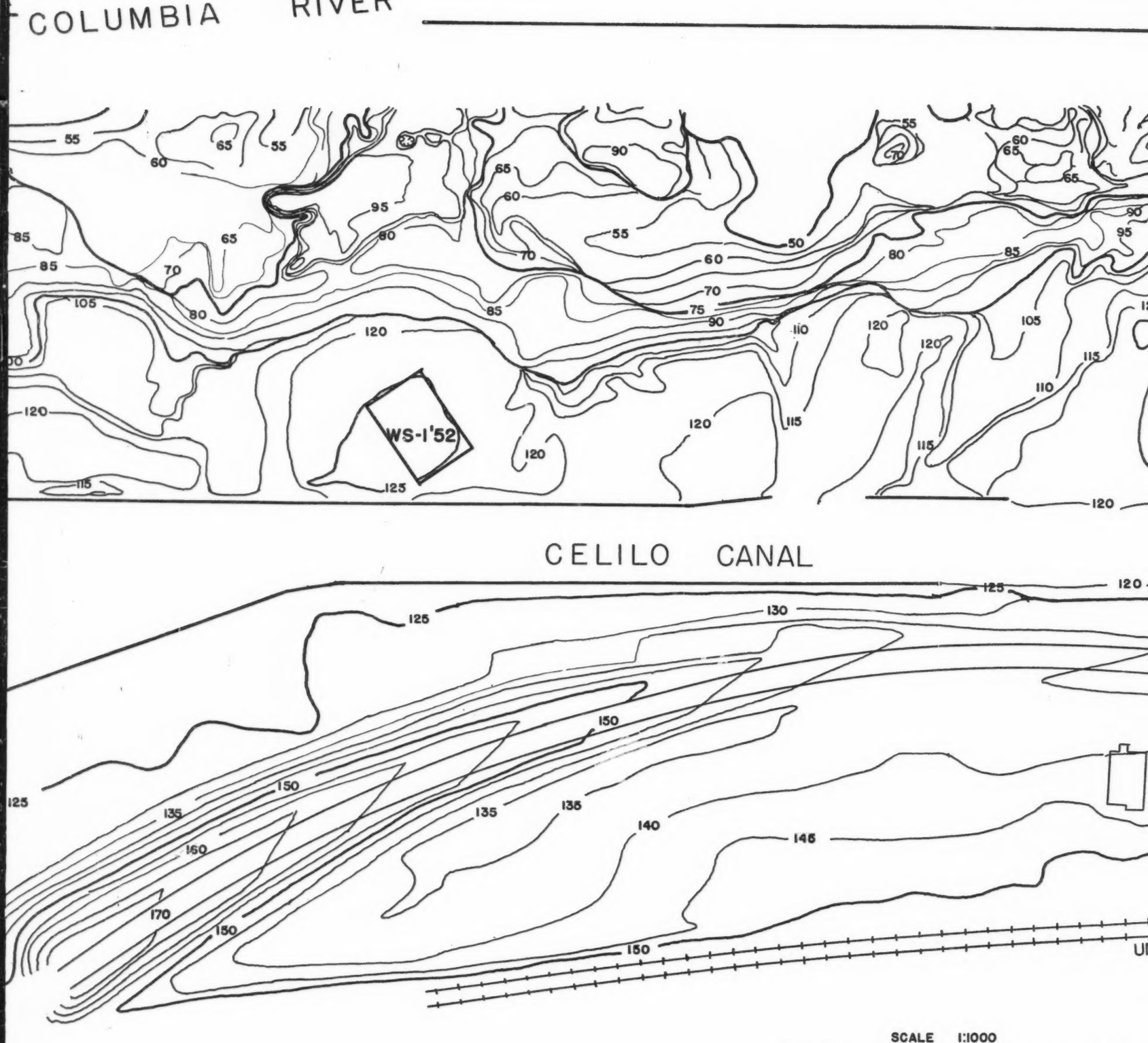
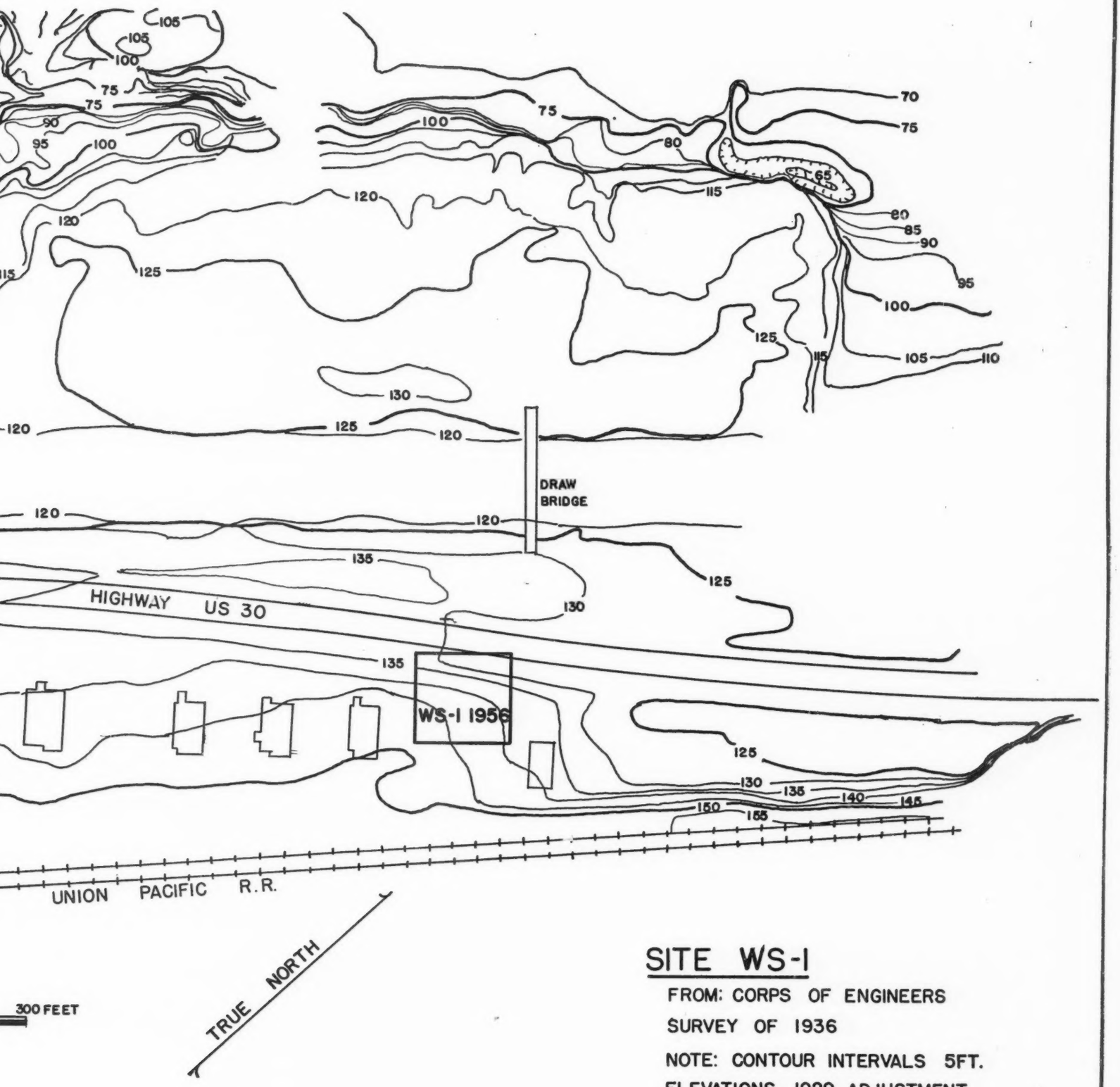


MAP 5.* Big Eddy area, 1936, showing excavation sites.



tion in the archaeological area and resulting disturbance of the surface.

MAP 5.* Big Eddy area, 1936, showing excavation sites.



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